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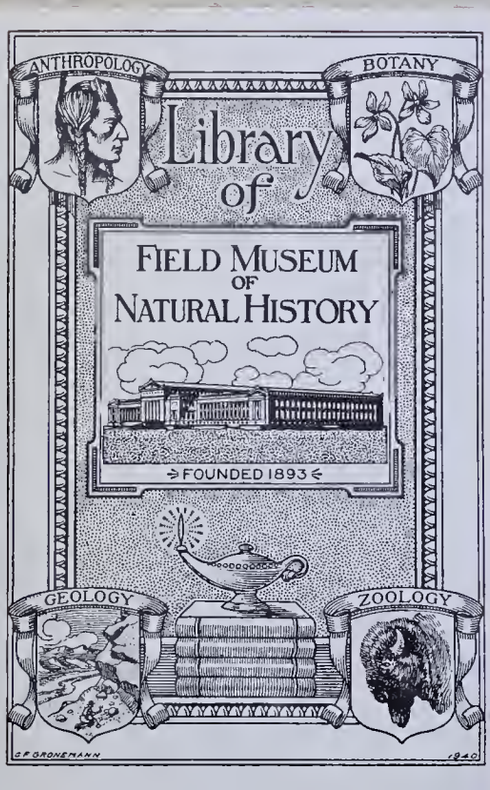

ZOOGRAPHY;

OR, THE

Beauties of Nature Displayed.

ZOOGRAPHY;

OR, THE

Beauties of Nature Displayed.

IN

SELECT DESCRIPTIONS

FROM

THE ANIMAL, AND VEGETABLE,

WITH ADDITIONS FROM

THE MINERAL KINGDOM.

SYSTEMATICALLY ARRANGED.

BY W. WOOD, F. L. S.

ILLUSTRATED WITH PLATES, DESIGNED AND ENGRAVED
BY MR. WILLIAM DANIELL.

IN THREE VOLUMES.

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SECOND VOLUME.

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ZOOGRAPHY;

OR THE

Beauties of Nature displayed.

REPTILES.

In this class are combined animals of the most disgusting appearance, and of the most venomous properties. We have here the loathsome toad, and the deadly rattle-snake; the terrific crocodile, and the smooth, cold lizard. To describe such an assemblage of beings appears incompatible with our title; and yet it is not so, since every part of nature has its beauties, and each, when properly considered, affords something worthy of observation. The toad, whose general appearance is so disgusting, can boast an eye of the most brilliant lustre; and we must acknowledge that many snakes, indepen-

dent of their graceful form, have skins that make them eminently beautiful.

With this apology (if an apology can ever be necessary for contemplating the works of an all-wise Creator) we shall proceed to describe such of the reptile tribe as contain any thing particularly interesting in their natural history.

TORTOISE.

GENERIC CHARACTER.

Body covered either with a horny or coriaceous integument.
Feet like fins.
Tail very short.

SPECIFIC CHARACTER.

TESTUDO GRÆCA. T. pedibus subdigitatis, testa postice gibba; margine laterali obtusissimo, scutellis planiusculis. *Linn. Syst. Nat. Gmel.* 1. p. 1043.

The toes hardly to be seen; shell very gibbous behind, having a thick margin, with flattish smooth plates.

TESTUDO GRÆCA. Testa hemispherica, seutellis disci subconvexis, flavis, nigro cinctis, margine laterali obtuso postice gibbo. *Schoepf. Hist. Test.* p. 38. pl. 8. 9.

Testudo terrestris vulgaris. *Raj. Quadr.* 243.

COMMON TORTOISE. *Shaw Gen. Zool.* 3. p. 9. pl. 1.

THIS is the small species which we sometimes meet with in a domesticated state. It arrives at a great age, even beyond the period of a century. One of them introduced into the archiepiscopal gar-

den at Lambeth about the year 1633, continued to live there till the year 1753, and then was supposed to have died from neglect rather than old age. Another was known to have lived 88 years in the garden of Samuel Simmons, esq., at Sandwich, in Kent. Its real age could not be ascertained, as it was upon the premises when Mr. Simmons took them, and was supposed to have been introduced there, from the West Indies, by Mr. Boys, who was the former possessor. This creature received a considerable injury, about thirty years before it died, from the wheel of a loaded waggon, which went over it and cracked its upper shell.

The common tortoise rarely exceeds eight inches in length, and seldom weighs more than three pounds. The shell of this little reptile is composed of thirteen middle pieces, and about twenty-five marginal ones; its colour varies in different individuals; and the plates, when the animal is very old, run as it were together, so as almost to lose the marks which separated them from each other. The under part of the shell is a pale yellow, with a broad dark line down each side, leaving the middle part plain. The upper part of the head is covered with tough scales, and the neck with small granulations. The legs are short, and the feet covered with strong scales, and generally armed with four strong claws; but this number is subject to vary, as the animal is sometimes found with five claws on the fore feet. The tail is rather

shorter than the legs, and covered with small scales which terminate in a hard pointed tip.

The agreeable manner in which Mr. White, in his History of Selborne, has detailed the manners of this little animal in its domestic state, will be a sufficient apology for inserting the account in his own words. "A land tortoise," says this gentleman, "which has been kept thirty years in a little walled court, retires under ground about the middle of November, and comes forth again about the middle of April. When it first appears in the spring, it discovers very little inclination for food; but in the height of summer grows voracious; and then, as the summer declines, its appetite declines; so that for the last weeks in autumn it hardly eats at all. Milky plants, such as lettuces, dandelions, sow-thistles, &c., are its principal food. On the first of November, 1771, I remarked that the tortoise began to dig the ground in order to form its hybernaculum which it had fixed on just beside a great tuft of hepaticas. It scrapes out the ground with its fore feet, and throws it up over its back with its hind; but the motion of its legs is ridiculously slow, little exceeding the hour-hand of a clock. Nothing can be more assiduous than this creature night and day, in scooping the earth, and forcing its great body into the cavity. But as the noons of that season prove unusually warm and sunny, it was constantly interrupted, and called forth by the heat in the middle of the day; and though I continued there till the thirteenth of November, yet the work

remained unfinished. Harsher weather, and frosty mornings, would have quickened its operations. No part of its behaviour ever struck me more than the extreme timidity it always expresses with regard to rain; for though it has a shell that would secure it against the wheel of a loaded cart, yet does it discover as much solicitude about rain as a lady dressed in all her best attire, shuffling away on the first sprinklings, and running its head up in a corner. If attended to, it becomes an excellent weather-glass; for as sure as it walks elate, and as it were on tiptoe, feeding with great earnestness in a morning, so sure will it rain before night. It is totally a diurnal animal, and never pretends to stir after it becomes dark.

"The tortoise, like other reptiles, has an arbitrary stomach, as well as lungs, and can refrain from eating, as well as breathing, for a great part of the year. I was much taken with its sagacity in discerning those that do it kind offices; for as soon as the good old lady comes in sight who has waited on it for more than thirty years, it hobbles towards its benefactress with awkward alacrity; but remains inattentive to strangers. Thus, not only "*the ox knoweth his owner, and the ass his master's crib,*" but the most abject and torpid of beings distinguishes the hand that feeds it, and is touched with the feelings of gratitude. This creature not only goes under the earth from the middle of November to the middle of April, but sleeps great part of the summer; for it goes to bed in the longest days at four in the

afternoon, and often does not stir in the morning till late. Besides, it retires to rest for every shower, and does not move at all in wet days. When one reflects on the state of this strange being, it is a matter of wonder that Providence should bestow such a seeming waste of longevity on a reptile that appears to relish it so little as to squander away more than two thirds of its existence in a joyless stupor, and be lost to all sensation for months together in the profoundest of all slumbers! Though he loves warm weather, he avoids the hot sun, because his thick shell, when once heated, would, as the poets say of solid armour, "*scald with safety.*" He therefore spends the more sultry hours under the umbrella of a large cabbage-leaf, or amidst the waving forests of an asparagus bed. But as he avoids heat in the summer, so in the decline of the year he improves the faint autumnal beams by getting within the reflection of a fruit-tree wall; and though he has never read that planes inclining to the horizon receive a greater share of warmth, he inclines his shell by tilting it against the wall, to collect and admit every feeble ray."

To these natural observations of Mr. White's we may add, that the tortoise not only feeds on various herbs and fruits, but on worms, snails, and insects, which it is supposed to devour in sufficient abundance to make it a useful inmate in a garden. The Greeks eat these reptiles, and are fond of the eggs, which are about the size of a pigeon's, and very good when boiled: they are of a white colour, and

four or five is the number which the tortoise generally lays. For this purpose the female scratches a hole in June, in a situation exposed to the sun, where, if the eggs are left undisturbed, they will be hatched in September, and produce an equal number of little creatures about the size of a walnut.

It has been ascertained by some experiments made abroad, that the tortoise loses very little weight during the months it remains concealed under ground. In all this time, which lasts from October till March, the animal remains without food; but this abstinence can be carried to a much greater length, according to Gerard Blasius, who kept one by him for ten months, without nourishment of any kind; and then tells us that, far from being starved to death, it was only killed by the cold. We have already expressed our abhorrence of these experiments, where the life of the animal is to be cruelly sacrificed to satisfy an idle curiosity. The following result of a set of experiments made by F. Redi, an Italian physician, will serve to prove two things; a great want of sensibility in the animal, and a total want of feeling in the doctor. "At the beginning of the month of November," as La Cepede has related the fact, "F. Redi made a large opening in the skull of a land tortoise, and removed the whole substance of the brain, cleaning out the cavity with great care. The eyes of the tortoise were instantly shut, and never afterwards opened; but being set at liberty, the animal continued to

walk about as well as before the brain was taken away. It advanced indeed in a boggling manner, as if groping its way, which it could now no longer see. In three days the wound was covered with new skin, and the tortoise lived, and continued all its ordinary motions, till the middle of May, nearly six months after it had been deprived of its brain. After death, a small black clot of dry blood was found in the cavity from which the brain had been taken out. He repeated this experiment on several tortoises, land, fresh-water, and even sea species, and they all continued to live, for longer or shorter times, after losing their brain.

TURTLE.

SPECIFIC CHARACTER.

TESTUDO MYDAS. T. palmarum unguibus binis, plantarum solitariis, testa ovata. *Linn. Syst. Nat. Gmel.* 1. p. 1037.

Two claws on each foot before, and one behind; shell oval.

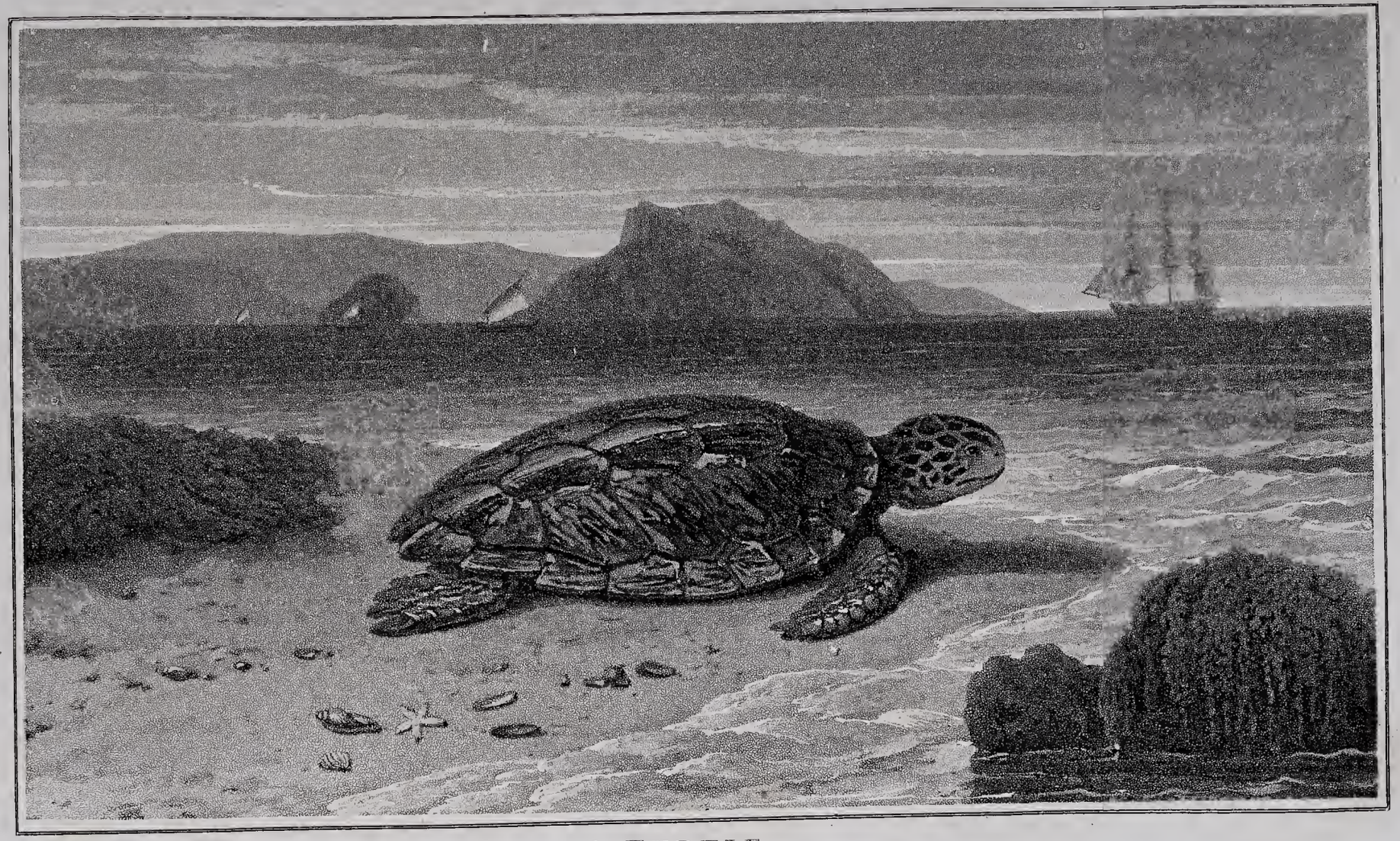
TESTUDO VIRIDIS. T. pedibus pinniformibus, unguibus palmarum binis, plantarum solitariis, testa ovata. *Schneid. Test.* p. 299. no. 1. pl. 2.

TESTUDO ATRA. *Mus. Ad. Frid.* 1. p. 50.

Testudo marina Americana, Mydas dicta. *Seb. Mus.* 1. pl. 80. fig. 9.

GREEN TURTLE. *Shaw Gen. Zool.* 3. p. 80. pl. 22.

THIS creature, which has so long been esteemed an article of the highest luxury, is a native of the West Indian seas, and has acquired its name from the green colour of its fat. They are so abundant in the West Indies, that Catesby informs us, from sir Hans Sloane, that forty sloops are employed by the inhabitants of Port Royal, in Jamaica, for the sole purpose of catching them; and that the markets are there supplied with turtles as ours are with butcher's meat. The account which Catesby has given us respecting the manner in which the inhabitants of the Bahama islands catch their turtles



TURTLE.

Designed by W. Daniell.

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is very satisfactory. These people are very expert at the business; and go out in the month of April, in little boats, to Cuba, and other neighbouring islands, where, in the evening, especially in moonlight nights, they watch the going and returning of the turtle to and from their nests, at which time they turn them on their backs, when they leave them and pass on, turning all they find; for when once laid upon their backs they are quite helpless, and can never more recover their feet. Some are so large that it requires three men to turn one of them. But the method most commonly employed to take turtle in the Bahama islands, is by striking them with a small iron peg about two inches long, put in a socket at the end of a twelve-foot staff. Two men generally set out for this work in a little light boat or canoe, one of whom is employed to row and gently steer the boat, while the other stands at the head of it with his striker. Sometimes the turtle are seen swimming with their head and back out of the water, but they are more frequently discovered lying at the bottom where it is a fathom or more deep. When a turtle perceives he is discovered, he immediately endeavours to escape, and is pursued by the men in the boat, who often lose sight of their prey, till the turtle rises to the surface of the water to breathe, when the chase is renewed, one paddling or rowing, while the other stands ready with his striker. In about half an hour, or perhaps sooner, the creature becomes exhausted, and sinks at once to the bottom:

they take this opportunity to pierce him with the iron peg, which slips out of the socket, but is fastened with a string to the pole. If the turtle is completely spent by being long pursued, he tamely submits, when struck, to be taken into the boat, or hauled ashore. A good diver will sometimes go to the bottom for one of these animals, and, getting upon his back, raise the fore part of him, and in this manner bring him to the surface, where a person waits in readiness to slip a noose about his neck and drag him on shore.

We are informed by La Cepede, that on the coast of Guinea the natives take these animals in a kind of net called a *fole*, which measures forty or fifty feet in length, and is fifteen or twenty feet broad. It is constructed of very strong line, and the meshes are about a foot square. Two floats made of a light prickly plant, called *moucou moucou* by the Indians, are fixed to the edge of every second mesh. Four or five stones, weighing about forty or fifty pounds each, are hung to the lower border of the net, in order to make it sink and keep it properly extended. The apparatus is completed by two large pieces of the *moucou moucou* fastened to the upper corners, to serve as buoys, and mark the situation of the net.

They place these nets about the small islands to which the turtle repair for the sake of the *fuci*, or sea-weed that grows on the adjacent rocks. The inhabitants carefully watch them; and as soon as the nets appear to sink in one place more than another they are drawn, and the prize secured.

Although a large turtle, in his native element, is able to exert a considerable degree of strength, yet he finds it extremely difficult to disentangle himself from the net, on account of the beating of the sea, which about those little islands is so much agitated as to keep the nets in continual motion. The turtles thus entangled are sometimes drowned, in consequence of the nets being neglected; or become the prey of sharks or sword-fish, who not only destroy the turtle but greatly damage the nets.

This species is not confined to the Indian seas alone, but visits the coasts of all the islands and continents of the torrid zone. They live upon the submarine plants that cover the bottom of the sea to a certain distance from the shore; there they may be seen, in calm and fine weather, feeding in numbers upon their marine pasture. In the intermission of their feeding they often retire into the outlets of the great rivers to indulge themselves with fresh water, where they frequently remain till their appetite recalls them to their former station. At these times they generally float with their heads above the surface of the water; but the instant they are alarmed by any hunters, or birds of prey, or even the shadow of any object, they suddenly plunge to the bottom. They never leave the water entirely unless it is to lay their eggs; and their annual visits for this purpose are thus described by Catesby: In the month of April they crawl up from the sea above the flowing of high water, and dig a hole above two feet deep in the sand, into

which they drop, in one night, above a hundred eggs. At this season they are so completely intent on performing this great command of nature, that they are totally regardless of surrounding objects, and would drop their eggs into a hat if held under them. If, however, they are disturbed before they begin to lay, they will forsake the place, and seek another. They lay their eggs at three, and sometimes at four different times, there being fourteen days between every time; consequently the broods are hatched at different times also. When they have laid all their eggs, which are about the size of tennis balls, and equally round, they cover them lightly with sand, that the sun may communicate to them a gentle warmth, and hatch their young. In about twenty or twenty-five days the young turtles are seen to rise out of the sand, and, guided by that instinct which never fails to direct them, march with a gentle pace to the water. But here they have to contend with an unruly element, by far too powerful for their little bodies; and are for several days beat back again by the waves and left on shore. Thus exposed, they remain a prey to the birds that hover about the coasts, and so many are carried off, or destroyed by different means, before they have sufficient strength to make proper efforts against the surges and dive to the bottom, that out of two or three hundred eggs it is but seldom that more than a third escape.

The turtle has been for several years held in the highest estimation in this country; and such is the

demand for the delicious food, that it is become an article of commerce, and ships are provided with conveniences for supplying them with water and provisions to bring them over in health from Jamaica and the other West India islands. They do not always succeed, however, in their attempts; for though the turtle are very tenacious of life, and scarcely require any provision during the voyage, yet they frequently lose flesh, and are impaired in flavour; so that to eat this animal in the highest perfection, we are told that instead of bringing the turtle to the epicure, he ought to be transported to the turtle.

The introduction of this article of luxury among our countrymen, cannot be traced beyond a very limited period. Dr. Shaw has collected two or three notices from The Gentleman's Magazine for the years 1753 and 1754, of large turtles dressed at different taverns; by which it appears that the creature was, at that time, rather a novelty, or the cooking of it would not have been honoured with a place in a newspaper.

FROG.

GENERIC CHARACTER.

Body naked.
Four legs; the feet divided into toes.
No tail.

SPECIFIC CHARACTER.

RANA TEMPORARIA. R. dorso planiusculo subangulato. *Linn. Syst. Nat. Gmel.* 1. p. 1053.
With a flattish subangulated back.
Rana palmis tetradactylis fissis, plantis pentadactylis palmatis; pollice longiore. *Fn. Suec.* 1. no. 250.
RANA FUSCA TERRESTRIS. *Roesel. Hist. Ran.* p. 1. t. 1—3.
RANA AQUATICA. *Raj. Quadr.* p. 241.
COMMON FROG. . *Penn. Brit. Zool.* 3. p. 9. *Shaw Gen. Zool.* 3. p. 97. pl. 29.

As it would be trifling with the reader to describe the form of a reptile with which he is so well acquainted, we shall at once proceed to relate the manner in which its spawn, by a regular progression, passes from a small black globule to a perfect frog. We shall here beg leave to quote the General

Zoology, as Dr. Shaw has paid great attention to this subject, and has detailed the particulars in his usual clear and satisfactory manner.

" It is generally in the month of March that the frog deposits its ova, or spawn, consisting of a large heap or clustered mass of gelatinous transparent eggs, in each of which is imbedded the embryo, or tadpole, in form of a round black globule. The spawn commonly lies more than a month*, or sometimes five weeks, before the larvæ or tadpoles are hatched from it; and during this period each egg gradually enlarges in size, and a few days before the time of exclusion, the young animals may be perceived to move about in the surrounding gluten. When first hatched they feed on the remains of the gluten in which they were imbedded; and in the space of a few days, if narrowly examined, they will be found to be furnished on each side the head with a pair of ramified branchiæ, or temporary organs, which again disappear after a certain space. These tadpoles are so perfectly unlike the animals in their complete state, that a person inconversant in natural history would hardly suppose them to bear any relationship to the frog; since, on a general view, they appear to consist merely of head and tail; the former large, black, and roundish; the latter slender, and bordered with a very broad transparent finny margin. Their motions are extremely lively, and they are often seen in such vast numbers as to blacken the

* This time varies considerably, according to the heat of the weather and other circumstances.

whole water with their legions. They live on the leaves of duck-weed and other small water-plants, as well as on the various kinds of animalcules, &c.; and when arrived at a larger size, they may even be heard to gnaw the edges of the leaves on which they feed, their mouths being furnished with extremely minute teeth or denticulations. The tadpole is also furnished with a small kind of tubular sphincter or sucker beneath the lower jaw, by the help of which it hangs at pleasure to the under surface of aquatic plants, &c. From this part it also occasionally hangs, when very young, by a thread of gluten, which it seems to manage in the same manner as some of the smaller slugs have been observed to practise. Its interior organs differ, if closely inspected, from those of the future frog in many respects; the intestines in particular are always coiled into a flat spiral, in the manner of a cable in miniature.

"When the tadpoles have arrived at the age of about five or six weeks the hind legs make their appearance, gradually increasing in length and size; and in about a fortnight afterwards, or sometimes later, are succeeded by the fore legs, which are indeed formed beneath the skin much sooner, and are occasionally protruded and again retracted by the animal through a small foramen on each side of the breast, and are not completely stretched forth till the time just mentioned. The animal now bears a kind of ambiguous appearance, partaking of the form of a frog and a lizard. The tail at

this period begins to decrease; at first very gradually, and at length so rapidly as to become quite obliterated in the space of a day or two afterwards."

Thus we have traced them from their imperfect state; and the first use they make of their feet is to leave the water, round the margin of which they may be seen in myriads, and sometimes cover a considerable space, filling every little puddle with their numbers.

The appetite of the frog changes with its form, since it is no longer content with the simple vegetable food which sufficed for its existence during its tadpole state, but seeks for snails, worms, and insects. To obtain these the creature quits its native element and wanders in the meadows, where it attentively watches the passing insects, till one comes sufficiently near; when the frog is seen to spring forward with great agility, dart out its tongue, and seize the prey with unerring certainty. This organ is particularly formed by nature for the purpose, being so placed that the root is attached to the fore rather than the hind part of the mouth, and when at rest lies with the tip towards the throat. This contrivance enables the frog to dart the tongue to a distance from the mouth, and the glutinous matter with which the tip is covered greatly contributes towards securing the prey.

These animals seem chiefly designed to live on insects; but they will not refuse to attack a large worm, though so badly calculated to secure the

writhing prey. Dr. Townson mentions the circumstance of a frog, which in his presence swallowed a blind worm near a span long. This proved such a perplexing morsel that the frog was a while before he could secure it, as in its struggles it frequently got its body out again; and when completely swallowed it must have proved very troublesome, as its contortions were plainly seen within the flaccid sides of the frog.

However singular it may appear, the fact is well authenticated; that frogs will sometimes adhere with the utmost tenacity to the backs of fishes. Not to mention the strange story told by Walton, of their destroying pike, we shall rely on the veracity of Mr. Pennant, who tells us that some years ago, on fishing a pond belonging to Mr. Pit, of Encomb, Dorsetshire, great numbers of the carp were found each with a frog mounted on it, the hind legs clinging to the back, the fore legs fixed in the corner of each eye of the fish, which were thin and greatly wasted, teased by carrying so disagreeable a load. These frogs were supposed to have been males disappointed of a mate.

Severe cold seems greatly to affect these creatures, and occasions them to become torpid. In the higher latitudes of North America they become absolutely frozen during the winter, and Mr. Hearne says that he has frequently seen them dug up with the moss in such a brittle state that their legs might be as easily broken off as the stem of a tobacco pipe, without giving them any pain. If they are warmly

wrapped up and exposed to the fire, they will regain their natural activity; but if suffered to freeze again, they can never more be restored to life.

Frogs are so very tenacious of life, that they will for a time survive the most cruel injuries, and have even been known to move about as usual for some time after the body has been laid open and the bowels removed. The barbarous trick which school-boys practise of skinning frogs, does not seem for some hours to abate their activity; and their life and motion are said to continue even after they have lost the whole of their circulating fluids.

We shall now proceed to notice what is deserving of remark in the other species; and the first that occurs is the *Rana esculenta*, or edible frog, which is nearly allied to the former, though it may be distinguished by the high protuberance in the middle of the back, as well as by the size, which is considerably larger than the common sort. These loathsome creatures are an article of traffic in other countries, though the stomach of an Englishman will not endure the food. In the Paris markets Mr. Pennant saw whole hampers full, which the venders were preparing for the table, by skinning and cutting off the fore parts, the loins and legs only being kept. Dr. Townson also in his Travels assures us that thirty or forty thousand at a time are brought from the country to Vienna, and sold to the dealers, who preserve them in large holes four or five feet deep, dug in the ground, covering the mouth with a board, or, when the weather is severe, with straw:

In these conservatories they remain during the winter, and never become quite torpid; for even during a frost, if taken out and placed on their backs, they have animation enough to be sensible of the change, and strength enough to turn themselves upon their legs. In these holes they are never supplied with water; nor is it necessary, as they instinctively get together in heaps, and thus prevent the evaporation of their humidity. Dr. Townson observes, that in Vienna, in 1793, there were only three great dealers, by whom most of those persons were supplied who brought them to the market ready for the cook.

The bull frog, *Rana Catesbeiana* of Shaw, is certainly the largest of the whole tribe, if we except the argus frog, which is allied to it both in size and manners. These creatures derive their name from their croaking, which is said to resemble the lowing of a bull, and in a still night may be heard to the distance of a mile and a half. Kalm tells us that as he was one day riding out, the roaring of one of these frogs really alarmed him, as he supposed it to be a bull concealed in the bushes at a little distance; and when he was afterwards undeceived by a party of Swedes to whom he communicated his fears, he could hardly believe that so formidable a roar could possibly proceed from so small an animal.

This species is common in the interior parts of America, where they sit in pairs by the side of the small rills. According to Catesby, there is scarcely a spring without a pair of them close to the hole from which the water runs. They choose this si-

tuation, that, when disturbed, they may leap into the mouth of the spring and hide themselves at the bottom. The Virginians, who believe they purify the water, respect them as the genii of the fountains, and hold them in such superstitious veneration, that they are afraid to kill one lest some dreadful misfortune should happen to their household. However, the less scrupulous get the better of their fears, especially where their interest is concerned; for such as breed geese and ducks are anxious to destroy these frogs, as they are extremely voracious, and very destructive to young water fowls.

We cannot give the reader a better idea of the agility of these animals than by relating the following story, which is well authenticated:—It is a well known fact, that an American Indian is able to run almost as fast as the best horse in his swiftest course. In order, therefore, to try how well the bull frogs could leap, some Swedes laid a wager with a young Indian, that he could not overtake one of them, provided he had two leaps before hand. The wager being accepted, they carried a bull frog, which they had caught in a pond, into a field, and burnt his tail. This application stimulated the creature to such a degree, that he made his long leaps across the field with wonderful celerity. The Indian pursued with all his might; and the noise he made in running, added to the fear the poor frog was probably in of a second burning, made him redouble his efforts, and reach the pond before the Indian could overtake him.

These reptiles grow to the size of eighteen inches and upwards, measured from the nose to the hind feet. Notwithstanding their hideous appearance the natives eat them, and one frog is said frequently to afford as much meat as a young fowl.

The tree frog, *Rana arborea* Linn., is a singular animal, and very unlike the rest; for, while they content themselves with the plain ground, this creature climbs the trees and resides principally on the upper branches, where it wanders about among the leaves in search of insects. The dexterity with which it catches its prey is remarkable: like a cat watching a mouse, it remains immoveable till an insect comes within a certain distance, when it creeps softly forwards, then makes a sudden spring of sometimes more than a foot in height, and infallibly seizes the victim. In order to enable these frogs to retain a situation which to a general observer must seem so contrary to the nature of the animal, they are provided with a concave fleshy pellet at the end of each toe, which is not unlike the mouth of a leech, and, being moreover soft and glutinous, enables the frog to attach itself with the greatest security to the leaves of trees, and even to the most polished surfaces. By these pellets they can suspend themselves at pleasure from the under surface of a leaf or branch, and thus remain concealed among the foliage.

About the end of autumn these frogs quit the trees and return to their native element, where they pass the dreary winter season in a torpid state,

sunk in the mud, or hid beneath a bank. In the spring they begin to revive, and, like the rest of the genus, deposit their spawn in the water. The appearance of the male at this period is completely altered; his throat being dilated in a surprising manner, and forming a large sphere beneath his head. His croak at this season is also very loud; and whenever one begins, all that are within hearing join the harsh discordant chorus, so that the noise of the whole is said to resemble a pack of hounds, and may sometimes be heard, when the evenings are very quiet, to the distance of near three miles. As soon as the young frogs have emerged from the tadpole state, they leave the water and ascend the trees.

The account which Dr. Townson has given us in his Tracts relative to two of these animals, which he kept by him for some time, is entertaining, and serves in some measure to illustrate their natural history. The doctor placed them among others in his window, and provided for them a bowl of water in which they lived. They soon grew tame; and the two which are the subject of the following account shared his favours above the rest; to these he gave the names of Damon and Musidora. Whenever they descended to the floor in hot weather they soon became lank and emaciated; and if a few drops of water were thrown upon the floor they constantly applied their bodies to it as close as they could, and from this absorption through the skin they soon recovered their plumpness, though they were very lank and flaccid before. In the evening they

seldom failed to return to the water, unless the weather was cold and damp; when they would sometimes remain out a couple of days. It is the character of these reptiles frequently to leave their natural food untouched while it remains in a quiet state, and to seize it the moment it begins to move. This Dr. Townson was aware of; and therefore, before the flies, which are their usual food, had disappeared in autumn, he collected, for his favourite Musidora, a great quantity as winter provision. When he laid any of them before her she took not the least notice, but suffered them to remain till he moved them with his breath, when she instantly sprung upon and devoured them. At one time, when flies were scarce, the doctor tried to cheat her by cutting the flesh of a tortoise into small pieces and moving them by the same means: but Musidora was not to be trifled with; she indeed seized them, but immediately afterwards rejected them from her tongue.

From some experiments on tree frogs which Dr. Townson made, he found that they frequently absorbed nearly the whole of their weight of water; and what is very remarkable, the absorption takes place by the under surface only of the body. Moisture from a wetted blotting paper is readily absorbed by them; and they have the power, it seems, of ejecting water with great force from their bodies, even to the quantity of more than the fourth part of their own weight.

Among the other observations which this gentle-

man made on the tree frogs, he noticed their cautious manner of swallowing humble bees. They do not seem much to enjoy the treat, as the enemy are never conquered without some contest. They are at first obliged to reject them on account of their sharp stings and rough hair; but they return again to the attack, and each time cover the bees with a viscid matter which proceeds from the frog's tongue, till they are at length sufficiently coated to be swallowed without injury. Their alertness in catching flies induced the doctor, while at Göttingen, to make them his guards for keeping these troublesome insects from his dessert of fruit; and he assures us they acquitted themselves to his satisfaction.

Captain Stedman has recorded a battle between one of this species and a snake, to which he was witness while paddling up a river of Surinam in a canoe. One of the officers who was in the canoe pointed out the objects in the top of a mangrove tree; and when they were first seen the head and shoulders of the frog were in the jaws of the snake, which, to use the captain's expression, was about the size of a large kitchen poker. This creature had its tail twisted round the tough limb of the mangrove, while the frog, which appeared about the size of a man's fist, had firmly grasped a twig with his hind feet. In this position they were contending, the one for his life, the other for his dinner, forming one straight line between the two branches; and thus they continued to behold them for some

time apparently stationary and without a struggle. Still it was hoped that the poor frog might extricate himself by his exertions; but the reverse was the case. The jaws of the snake gradually relaxing, and by their elasticity forming an incredible orifice, the body and fore legs of the frog by little and little disappeared, till finally nothing more was seen than the hinder feet and claws, which were at last disengaged from the twig, and the poor creature was swallowed whole, by suction, down the throat of his formidable adversary. He passed some inches further down the alimentary canal, and at last stuck, forming a knob or knot at least six times as large as the snake, whose jaws and throat immediately contracted, and reassumed their former natural shape. As the creature was beyond their reach, they could not kill him as they wished to do for the purpose of a closer examination, but left him in the same attitude, motionless, and twisted round the branch.

The peculiar manner in which respiration is carried on in frogs as well as other reptiles is worthy of observation. The organs contrived for this purpose are placed in the mouth, which is never opened in order to breathe, as the air passes through two small openings or nostrils at the front of the upper part of the head. It is indeed necessary that the jaws should continue closed while they respire, as they cannot perform this necessary operation at all if they remain open. When a frog is observed with attention, a frequent dilatation and contraction in the skinny and flaccid part of the mouth which

covers the lower jaw will be perceived, and every time this part moves, a corresponding twirling motion may be observed in the nostrils. By this twirl the air is let into the mouth, and the skin becomes dilated; whence it passes through a slit for that purpose behind the tongue into the lungs, from whence it is again expelled by the muscles of the abdomen, and followed by the same expansion of the cheeks and twirl of the nostrils. Thus the lungs are filled by the action of the muscles of the jaws, and frogs swallow air nearly in the same manner as we swallow food.

TOAD.

SPECIFIC CHARACTER.

RANA BUFO. . R. corpore lurido fuscoque. *Linn. Syst. Nat. Gmel.* 1. p. 1047.

With a body of a lurid dusky colour.

Rana palmis pentadactylis fissis, plantis hexadactylis palmatis; pollice breviore. *Fn. Suec.* 1. no. 253.

Bufo terrestris, dorso tuberculis exasperato, oculis rubris. *Roesel. Hist. Ran.* p. 85. pl. 20.

COMMON TOAD. *Penn. Brit. Zool.* 3. p. 14. *Shaw Gen. Zool.* 3. p. 138. pl. 40.

THE toad, of all reptiles, is the most detested; its very name excites disgust, and the mere remembrance of its hideous deformity will produce, on weak and delicate nerves, that coldness and shivering which almost infallibly accompanies its touch. We are taught to consider it with sensations of loathing, and to regard it with horror. Few of us can so far conquer our prejudices as to contemplate the only beauty in the animal, its brilliant eyes, which are remarkably fine, and, if placed in a less hideous situation, would be noticed by every body. The toad has long been persecuted for possessing a

number of noxious qualities which only exist in the imagination of its enemies, since the animal is perfectly innocent, and quite incapable of doing harm. Had it been its good fortune to have possessed a better shape, we should have had a better opinion of its nature, and the many stories that have been told of its venomous disposition would have wanted a foundation.

The spawn of the toad, which is deposited in the spring, may be easily known from that of the frog, by the appearance of the mass, which consists of two rows of black eggs, in the form of a double necklace of beads, contained within a case of transparent gluten. In this they remain about fifteen days, and then pass through the tadpole state in the same manner as has been already related respecting the frog.

Where persons have so far overcome their natural antipathy to this reptile as to give him encouragement, they have not found it at all difficult to make him very familiar: we know one or two families who, notwithstanding the vulgar prejudices against these creatures, have *dared* to keep a toad for some years in their house; and Mr. Pennant has recorded some curious particulars in his British Zoology respecting one of these animals. The toad in question was a great favourite in the family of Mr. Arscott, where he had lived for more than thirty-six years. His real age could not be ascertained, as he had frequented some steps before the

hall door for some years before this gentleman became acquainted with him; but he remembers that his father used to call him the old toad. By constantly being fed, this creature was brought to be so tame that he always came to the candle and looked up as if expecting to be brought upon the table, where he was usually treated with insects of all sorts. Fresh maggots appeared to be his favourite food: these he would follow, and, when at a proper distance, fix his eye upon the object and remain motionless for a few seconds; after which he would dart out his tongue upon the maggot, and secure it with a motion too quick for the eye to follow. A toad so much taken notice of and befriended excited the curiosity of all who came to the house, so that even ladies so far conquered the horrors instilled into them by nurses, as to desire to see it fed.

In answer to some queries put to him by Mr. Pennant respecting this animal Mr. Arscott says, "No toads that I ever saw appeared in the winter season. The old toad made its appearance as soon as the warm weather came, and I always concluded it retired to some dry bank to repose till the spring. When we new-laid the steps I had two holes made in the third step on each, with a hollow of more than a yard long for it, in which I imagine it slept, as it came from thence at its first appearance.

"It was seldom provoked; neither that toad (nor the multitudes I have seen tormented with

great cruelty) ever showed the least desire of revenge, by spitting or emitting any juice from their pimples. Sometimes, upon taking it up, it would let out a great quantity of clear water, which, as I have often seen it do the same upon the steps when quite quiet, was certainly its urine, and no more than a natural evacuation."

In all probability this poor fellow would have lived much longer if he had not been brought to an untimely end by a tame raven, who one day seeing him at the mouth of his hole, pulled him out, and, before he could be rescued, destroyed one of his eyes, besides bruising him so much, that notwithstanding he lived a twelvemonth, he is said never to have enjoyed himself. After this accident he had a difficulty in taking his food, as he frequently missed the mark for want of his eye.

During the heat of the day toads will never venture from their hiding-places except upon extraordinary occasions; therefore Mr. Arscott was surprised when he once from his parlour window observed a large toad which he had in the bank of a bowling-green, about twelve at noon, in very hot weather, extremely busy and active upon the grass: so uncommon an appearance made him go out to see what it was; when he found an innumerable swarm of winged ants had dropped round his hole, which, he concludes, was a temptation as irresistible as a turtle would be to a luxurious alderman.

Many an unhappy patient has depended upon

these creatures for relief from one of the most horrible of all diseases, and great numbers of toads have been sacrificed at the cancered breast, without producing any of those permanently good effects which were at first expected from them. The reptiles were each tied up in a linen bag, all except the head, which was applied to the breast, where the animal immediately fastened and sucked till he dropped off. This operation constantly proved fatal to the toads. They all swelled exceedingly, and some dropped dead from the wound, while others lived for some time afterwards.

We learn from the Count de la Cepede, that at Carthagena and Porto Bello in America, toads are so extremely numerous, that in rainy weather not only the marshy grounds, but the gardens, courts, and streets, are almost entirely covered with them; insomuch that the inhabitants have conceived that each drop of rain is changed into a toad. In these countries this creature grows to a great size, the least being six inches in length. If it happens to rain during the night, they all quit their hiding-places, and crawl about in such inconceivable numbers as almost literally to touch each other, and to hide the surface of the earth, so that the people can hardly stir out of doors without trampling them under foot at every step.

Many stories have been told of toads found alive in the middle of blocks of stone, where they have been supposed to have lived for ages, and some of these accounts are seemingly well attested; yet we

cannot help denying our belief of what appears so exceedingly unnatural. That an animal, however tenacious of life, should exist for many years enclosed within a solid body, and in a space no larger than itself, deprived of air, food, and motion, appears too marvellous to be credited.

We cannot quit this genus without noticing the most extraordinary of all its species. The Surinam toad, *Rana Pipa* Linn., exhibits a phænomenon which is not to be equalled in the whole range of animated nature. The young, instead of being produced in the common manner, are hatched in the back of the female, from whence they are excluded completely formed. For this purpose she is provided by nature with a certain number of cavities, or cells, which open outwards, and are about half an inch deep. Dr. Shaw says it was a long time supposed that the eggs in this extraordinary animal were produced in the dorsal cells, without having been first excluded in the form of spawn. It seems however that this is not the case; for Dr. Fermin, to whom we are indebted for the most accurate observations on this animal, has proved that a still more wonderful process takes place, and that the spawn after being excluded is received into the open cells of the back, where it remains till the little toads have arrived at maturity. Dr. Fermin declares that at a certain period of this process a little live toad is to be found in each of the cells, which is an exact resemblance

of the parent in miniature; that the creature does not adhere to the back of the mother, but may be easily taken out as from a case, and again replaced without injury. How they find subsistence in that situation he does not pretend to determine. The manner in which these very remarkable creatures manage their spawn is thus related by the doctor: the eggs are generated within the body of the female, and at the proper period are deposited in the usual manner at the brink of some stagnant water. The male amasses the heap of eggs, and deposits them with great care on the back of the female, where, after impregnation, they are pressed into the cellules, which at that period open for their reception, and afterwards close over them. The eggs are thus retained till the period of their second birth, which happens in somewhat less than three months, when they emerge from the back of the parent completely formed. During the time of their concealment, however, they pass through the usual stages, first becoming tadpoles and then perfect toads.

It appears from the observation of Dr. Fermin, that the pipa is only calculated by nature to produce one brood, and that the number of young produced by the female he examined amounted to seventy-five; so that this species is by no means so prolific as the rest of the genus. He noticed that the young were all excluded in five days after they first appeared.

This hideous reptile was first described by Ruysch, and afterwards by both Merian and the editor of Seba's Museum; but the observations of Dr. Fermin are the most valuable, as his residence in Surinam gave him every opportunity he could desire to investigate the creature.

FLYING DRAGON.

GENERIC CHARACTER.

Body naked; furnished on each side with a wing-like skin.
Four legs; each foot divided into five toes.
Tail very long.

SPECIFIC CHARACTER.

Draco volans.	D. brachiis ab ala distinctis. *Linn. Syst. Nat. Gmel.* 1. p. 1056.
	Dragon with wings not attached to the fore legs.
	Lacerta cauda tereti, pedibus pentadactylis, alis femore connexis, crista gulæ triplici. *Amœn. Acad.* 1. p. 540.
	Lacerta africana volans, sive Draco volans. *Seb. Mus.* 2. pl. 86. f. 3.
	Lacerta volans indica. *Raj. Quadr.* p. 275.
Flying Dragon.	*Shaw Gen. Zool.* 3. p. 117. pl. 54. *Nat. Misc.* 1. pl. 8.

The very name of this creature, will recall to the imagination of our readers the terrific dragon that filled the minds of poets, and was so much celebrated in the romances of the middle ages. The idea of this airy monster probably originated from

FLYING DRAGON.

Designed by W. Daniell.

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the small, weak, and perfectly innocent animal which we shall presently describe. Poets and romancers could readily expand their ideas, and add forty feet to the length of a lizard: they extended his lateral membranes to mighty wings, and gave him a head and tail of their own, fraught with every thing that was terrible and malignant.

Dr. Shaw has given so good a description of the form of this animal, that we shall beg leave to introduce it in his own words: "The total length of this highly curious creature is commonly about nine or ten inches, or at most a foot; the tail being extremely long in proportion to the body, which does not measure more than about four inches in length. The head is of a very singular form, being furnished beneath with a very large triple pouch or process, one part of which descends beneath the throat, while the two remaining parts project on each side; all are sharp-pointed, and seem analogous in some degree to the gular crests of the guana and other lizards, but are still more conspicuous in proportion to the size of the animal. The head is of moderate size; the mouth rather wide; the tongue large, and thick at the base; the teeth small and numerous; the neck rather small; the body and limbs somewhat slender, and universally covered with small acuminated and closely-set scales, which incline more to a minutely aculeated appearance on the tail. The colour of the dragon on the upper parts is an elegant pale blue, or blueish gray, the back and tail being marked by several

transverse dusky undulations or bars, while the wings are very elegantly spotted, more especially towards the broadest part, with differently shaped patches of black, deep-brown, and white: the border of the wings is also white; and the whole under surface of the animal is of a very pale or whitish brown colour."

These reptiles inhabit Asia, Africa, and America, where they are seen flying from tree to tree, and feeding on ants, flies, and other insects. They are said to make a noise with their wings, which may be readily heard as they fly from one tree to another, and that they are able to support themselves in the air during a flight of thirty paces. Le Barbinais, a French voyager, quoted by La Cepede, has evidently described this species, which, he says, is about a foot long, with four legs like those of common lizards. He observes that the head is flat, having an opening in the middle, through which a needle might be passed; that the wings are very thin; and that the neck is surrounded by a sort of ruff, not unlike the wattles on the throat of a cock. He met with them in abundance in a small island near Java, where he tells us they flew from tree to tree like locusts. He killed one of them, and was anxious to preserve it for the sake of its beautiful colours, but the heat of the climate prevented him.

Several impositions have been passed upon the public, of different animals stuffed in a peculiar manner, so as to represent what those who have

only heard of the animal, might suppose to be a dragon. The most notable instance of this kind of deception was practised in Holland some years ago, when a Hamburgh merchant professed to have a real dragon in his possession, which he valued at 10,000 florins. The deception, however, was found out by Linnæus, who declared it to be an ingenious combination of the skins of snakes, teeth of weasels, claws of birds, &c. It appears that the merchant was so enraged at the discovery, that he threatened to prosecute the naturalist for injuring his property, who, to avoid his wrath, thought proper to leave Hamburgh. Seba has given a figure of this curiosity, which, however, he does not pretend to say was ever in existence.

LIZARD.

GENERIC CHARACTER.

Body either smooth, warty, or covered with scales.
Four legs; the feet divided into toes.
Tail long.

CROCODILE.

SPECIFIC CHARACTER.

LACERTA CROCODILUS. L. capite cataphracto, nucha carinata, cauda superne cristis binis lateralibus horrida. *Linn. Syst. Nat. Gmel.* 1. p. 1057.

With a mailed head; neck carinated; tail furnished on the upper part with two lateral crested processes.

Lacerta cauda compressa serrata, pedibus triunguiculatis, palmis pentadactylis, plantis tetradactylis palmatis. *Linn. Syst. Nat.* xii. 1. p. 359. no. 1.

CROCODILUS. *Seb. Mus.* 1. t. 105. f. 3, 4.

CROCODILUS NILOTICUS. *Jacob. Mus.* 1. pl. 7. f. 55.

CROCODILE. . . . *Shaw Gen. Zool.* 3. p. 184. pl. 55.

THIS very formidable creature is happily confined to the immense rivers of the warmer regions, where it grows to a large size, and becomes the terror of

CROCODILE.

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the neighbouring inhabitants. It is usually found from the length of fifteen to twenty feet, and sometimes longer, as is mentioned by Brue in his Voyage to Senegal. This gentleman found them in great abundance about Ghiam, where they are very dangerous and of a large size, some of his attendants having killed one which measured twenty-five feet. We must conclude, however, that this was of an extraordinary magnitude, since the natives were overjoyed at his death, supposing him to be the father of all the rest, and that his defeat would alarm the others and make them leave the place. Although the crocodile in his general form resembles other lizards, yet he has many characters which sufficiently distinguish him. His long flattened head, with his enormously large mouth set with two rows of formidable teeth, would be enough to separate him from the rest of the genus, independent of any other peculiarity. It has been asserted, that the upper jaw in this animal is moveable; but a very little attention will convince us of the contrary, and that in fact the crocodile has precisely the same motion in the jaws as other quadrupeds. It was likewise supposed that the creature had no tongue; this, however, is not the case, though it is so firmly attached to the two sides of the lower jaw by means of a membrane, that it cannot be thrust out of the mouth. The fiery appearance of his eyes, which are placed obliquely, together with the wrinkled eyelids, increase the natural malignity of his aspect, and seem to

animate the countenance with rage, even in the animal's most tranquil moments. The almost impenetrable armour which defends the body of the crocodile is composed of hard scales, continued from the head to the tail, which is very long; and besides the common covering has two rows of upright processes which proceed from the lower part of the back. The legs and feet are very strong, and the latter are furnished with sharp curved claws. The colour of the crocodile when arrived at his full size is a dark brown above, approaching to black; the under side is yellowish white.

Crocodiles are seen in vast shoals in some of the large rivers of Africa, where they float upon the surface without any apparent motion, and have been frequently mistaken, at a little distance, for the trunks of trees covered with a rough bark. This appearance of torpidity, however, is merely assumed by the creature to deceive his prey; for the moment an animal approaches within reach he darts upon it, and sinks at once to the bottom. In this manner of attack the crocodile is said by Dr. Shaw to be exactly imitated by the lacerta palustris, or water newt, which, though not more than four or five inches long, will swallow an insect of more than an inch in length with one single effort, and that with a motion so quick that the eye can scarcely follow it. To accomplish its purpose the newt poises itself in the water, and having gained a proper distance springs at once upon its prey. Dr. Shaw justly observes, that if a small lizard of four or

five inches only in length can thus instantaneously swallow an insect which bears so large a proportion to its whole body, we need not wonder that a crocodile of eighteen, twenty, or twenty-five feet long should suddenly ingorge a dog or other quadruped. These terrific animals are also frequently met with on the banks of large rivers, where they wait concealed among the sedges till some living creature is unfortunate enough to come within their reach, when they instantly rush forward and secure the victim. Catesby describes them as frequenting the great American rivers, within reach of the tide, where they remain concealed among the thick forests of mangrove trees that line their slimy banks, and greatly resemble the trunk of a fallen tree covered with mud. This author likewise assures us that they swallow stones and other substances; and that the stomachs of many which he opened contained large clumps of wood and pieces of pine-tree coal, some of which weighed seven or eight pounds, and were worn so smooth that he supposes they must have remained there for some months. It is well ascertained that the crocodile will endure a long fast, and it is when pressed by hunger that he is supposed to swallow these substances, in order to distend the stomach and abate the cravings of nature. Their ability to remain a considerable time without food was proved by Brown, who in his History of Jamaica tells us that he has frequently seen them put into ponds, where they have lived

several months without any aliment, having had their jaws previously tied together with wire.

We should naturally conclude, from the very formidable appearance of this animal, that he would be left unmolested by mankind, as an object too powerful for them to contend with; yet this is far from being the case; for the negroes in the neighbourhood of the river Senegal will boldly attack him, and frequently prove victorious. Mr. Adanson gives the following account of an engagement between a negro and a crocodile seven feet long, which the negro discovered sleeping among some bushes at the foot of a tree near the banks of a river. When the man was convinced that the crocodile was asleep he approached with great caution, and gave him a deep wound with a knife on the side of the neck: the animal, though mortally wounded, struck the negro so violently on the legs with his tail as to knock him down; but without quitting his hold, he rose instantly, and slipped a rope over the muzzle of the crocodile, while one of his companions secured his tail: Mr. Adanson then mounted on his back to hold him down, while the negro drew out the knife from the wound and cut off his head. Notwithstanding their general ferocity there are some negroes who will venture to attack them in their own element, and merely armed with a dagger. Mr. Brue mentions one of the garrison of Fort St. Louis who used very frequently to do this by way of amusement, and was long success-

ful; but at last he was so severely wounded in one of these combats, that he must have perished if he had not been assisted by some of his companions.

It is not usual for the crocodile to attack mankind unless when pressed by hunger; when they sometimes become furious, and will brave any danger to satisfy their appetite. Children on the banks of the Nile have frequently been destroyed by these terrible animals, and Hasselquist relates, that in Upper Egypt they often devour the women who come to the banks of the river for water. They generally secure their prey by sweeping it off the banks with their tail, and then dragging it to the bottom. It sometimes happens that the wounded creature the monster has thus surprised escapes from his grasp, and endeavours to save itself by flight, but the crocodile immediately pursues and frequently overtakes his prey, which is then dragged back to the river and inevitably destroyed. The crocodile can run tolerably fast upon level ground and in a straight direction; but the time he takes to turn himself round gives a person a fair chance to escape: accordingly we are told of an Englishman who was pursued so quickly by a large crocodile, which came out of the lake Nicaragua, that unless the Spaniards who were in his company had cried out for him to quit the straight road, and run in a circle, he must have been caught.

We learn from the information of M. de la Borde, that in the spring the female crocodile of South America prepares a small hillock of sand, by

the side of the river, with a hollow in the middle, which she lines with leaves and other vegetable matter. In this place she deposits her eggs, and then covers them with leaves. She performs this first command of nature with great caution: being aware of the many enemies which attend to destroy her progeny, she carefully looks around, and the presence of a man, a beast, or even a bird, is sufficient to deter her from her purpose, and cause her to retire. If, however, all is quiet and no one in sight, she slowly steals from the water and deposits her burthen. The eggs are not all laid at one time, but at intervals of a few days, and the number from one female amounts to about a hundred in a year. It is remarkable that the egg of such a monstrous animal should scarcely be larger than that of a goose, to which indeed it bears a great resemblance, being shaped like it, and covered with a calcareous shell, having a membrane underneath. In the British Museum there is one preserved in spirits, together with the young crocodile about five inches long.

The eggs are hatched solely by the heat of the sun, and the young crocodiles escape from their confinement at the appointed time, by breaking the shell either with the head or with the serrated tubercles on the back.

> "So from his shell, on Delta's showerless isle,
> Bursts into birth the monster of the Nile."

The moment they are liberated they proceed to

the water, where they are enabled to subsist from their birth without any assistance from others. But few, however, in proportion to the number of eggs which are laid by these creatures, ever come to maturity. The natives are very fond of them, and are constantly seeking their nests. The ichneumon is always upon the watch, and destroys great numbers; to which may be added the vultures mentioned by Ulloa. These birds seem appointed by Providence to abridge their fecundity; they hide themselves among the branches of the trees near the banks of the river, and in silence mark the spot where the crocodile lays her eggs; but the moment she retires they call each other to the feast, and, flocking all together upon the hidden treasure, tear up the eggs, and devour them in a much quicker time than they were deposited.

The crocodile was exhibited by the Romans among the various animals which they occasionally introduced in their public spectacles. During the ædileship of Scaurus, five of these animals were presented to the people in the public shows; and Augustus provided one to grace his triumph over Cleopatra, besides others, at different times, for the entertainment of the people.

The trifling difference in form between the crocodiles of the Nile and those of America has induced some naturalists to describe them as distinct species. The difference however is so slight, that others have considered them only as varieties which

they supposed to be owing merely to the effect of climate. The American crocodile is distinguished by the name of alligator, which appears to have originated in the Spanish sailors remarking their great resemblance to a lizard, which they call *lagarto*. Our countrymen, when they arrived and heard the name, called the animal *a lagato*, whence at length was derived the word *alligato*, or alligator.

GUANA.

SPECIFIC CHARACTER.

LACERTA IGUANA. L. cauda tereti longa, sutura dorsali dentata, gula crista denticulata. *Linn. Syst. Nat. Gmel.* 1. p. 1062.

Tail long and round; back serrated; throat with a denticulated crest.

Lacerta cauda tereti, pedibus pentadactylis, crista dorsi longitudinali, gulæ pendula antice dentata. *Amœn. Ac.* 1. p. 123. 287.

IGUANA DELICATISSIMA. *Laur. Amph.* p. 48. no. 71.

Lacertus Senembi et Iguana. *Raj. Quadr.* 265.

COMMON GUANA. *Catesb. Car.* 2. p. 64. *Shaw Gen. Zool.* 3. p. 199. pl. 61.

THIS lizard is as eminent for the beauty of its colours, as for its strange and peculiar form. The large pouch beneath the throat, the row of serratures along the back, and the strong claws which arm the feet, give it a terrific and malignant appearance, very contrary to its nature. The guana inhabits America and the West India islands, where it is said to have become scarce on account of the delicacy of its flesh, which is highly prized. The

general length of this animal is from three to five or six feet, and its skin is covered with small scales, which are highly polished and of a green colour, but subject to vary in different individuals. They are found in woods, among the branches of the trees, where they feed on insects, and sometimes on vegetables. When either frightened or irritated they appear very formidable, as they can inflate their bodies to a large size, and erect the scales on the back; which, together with the hissing noise they make at the time, and the fiery appearance of their eyes, has occasioned great alarm to those travellers who have been unacquainted with their naturally gentle and harmless manners.

These animals are hunted in several parts of America for the sake of their flesh, and dogs are frequently trained up for the purpose. They are said likewise to be caught in traps, and are sometimes taken alive by the Indians, who, according to Labat, make use of the following artifice to effect their purpose: The Indian who intends to catch the guana provides himself with a long rod, to the end of which he fastens a piece of whipcord formed into a running noose. With this simple apparatus he repairs to the woods; and having found the object of his pursuit extended on the branch of a tree, and in a quiet state, he advances slowly towards it, whistling in a manner which attracts the attention of the guana; who, pleased with the sound, turns towards the place from whence it comes, and stretches out its neck as if unwilling to lose a note. Thus

soothed and delighted, the animal suffers the person to advance his rod gently, and rub it against its sides and throat. This additional pleasure completes its ruin; for the guana, beyond measure gratified by this operation, turns on its back to enjoy the tickling, while the treacherous negro slips the noose over its neck, and drags it to the ground.

Catesby, during his residence in America, made the following observations on these animals: "Guanas are of various sizes, from two to five feet in length: their mouths are furnished with exceeding small teeth, but their jaws armed with a long beak, with which they bite with great strength. They inhabit warm countries only, and are rarely to be met with any where north or south of the tropics. Many of the Bahama islands abound with them, where they nestle in hollow rocks and trees; their eggs have not a hard shell, like those of alligators, but a skin only, like those of a turtle, and are esteemed a good food. They lay a great number of eggs at a time in the earth, which are there hatched by the sun's heat. These guanas are a great part of the subsistence of the inhabitants of the Bahama islands; for which purpose they visit many parts of the remote *kayes* and islands in their sloops to catch them, which they do by dogs trained up for that purpose, which are so dexterous as not often to kill them; which if they do, they serve only for present spending: if otherwise, they sew up their mouths to prevent their biting, and put them into the hold of their sloop till they have

catched a sufficient number; which they either carry alive for sale to Carolina, or salt and barrel up for the use of their families at home. These guanas feed wholly on vegetables and fruit, particularly on a kind of fungus growing at the roots of trees, and on the fruits of the different kinds of *annonas*. Their flesh is easy of digestion, delicate, and well tasted: they are sometimes roasted; but the more common way is to boil them, taking out the leaves of fat, which are melted and clarified, and put into a calabash or dish, into which they dip the flesh of the guana as they eat it. It is remarkable that this fat, which adheres to the inside of the abdomen, imbibes the colour of the fruit the animal eats last, which I have frequently seen tinged of a pale red, yellow, or sometimes of a purple colour; which last was from eating the *Prunus maritima*, which fruit, at the same time, I took out of them. Though they are not amphibious, they are said to keep under water about an hour. When they swim they use not their feet, but clap them close to their body, and guide themselves with their tails; they swallow all they eat whole. They cannot run fast, their holes being a greater security to them than their heels. They are so impatient of cold, that they rarely appear out of their holes but when the sun shines."

This species, like the rest of the tribe, will live a considerable time without food. Mr. Browne domesticated a guana in Jamaica, which was never observed to eat any thing except a few almost imper-

ceptible particles which were floating in the air. When first he took this creature into the house, it was very fierce and ill-natured; but after some days its temper improved, and at length it would pass the greatest part of the day upon the bed or couch, but went out regularly every night. Mr. Browne adds, that the guana may be very easily tamed while young, and is then both an innocent and beautiful companion.

The female guana is described as smaller than the male; she is said to be more elegantly shaped, and to have brighter scales. These beauties, it seems, are not lost, since they are productive of the most violent attachment in the male, who becomes furious when she is in danger, and will defend her person at the expense of his life.

In the spring the female retires from the woods to the sea-shore, in order to deposit her eggs, which are about the size of a pigeon's, and generally from fifteen to twenty in number. These eggs are reckoned a delicacy, and are said to give an exquisite relish to sauces. The animal itself, according to Mr. Browne's account, is so excellent, that when fricasseed, and served up at table, it is often preferred to the best poultry.

CHAMELEON.

SPECIFIC CHARACTER.

LACERTA CHAMÆLEON. L. cinerea, pileo plano. *Linn. Syst. Nat. Gmel.* 1. p. 1069, cauda tereti brevi incurva, digitis duobus tribusque coadunatis. *Linn. Syst. Nat.* p. 264.

Colour gray; crown of the head flat; tail round, and incurvated; five toes on each foot joined two and three together.

CHAMÆLEON TERRESTRIS. *Calceol. Mus.* 658. pl. 661.

CHAMELEON. . . . *Mus. Lever.* 1. p. 194. *Miller Cim. Phys.* p. 22. pl. 11. *Shaw Gen. Zool.* 3. p. 253. pl. 76.

THE long abstinence which the chameleon, in common with other lizards, is capable of supporting, has given rise to the vulgar opinion that the animal lives upon air: this is far from being the case; it feeds upon flies; and their remains, together with the parts of other insects, have been found in its stomach. The other property possessed by this creature, that of changing the colour of its body, appears to be much better ascertained; and, far from resting on a single authority, is supported by a learned body of French academicians. The

CHAMÆLEON.

Designed by W. Daniell.

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curious and particular account they have given of the fact, will be best detailed in the following translation of their own words:

" The colour of all the eminences of our chameleon when it was at rest, in the shade, and had continued a long time undisturbed, was a blueish gray, except under the feet, where it was white inclining to yellow; and the intervals of the granules of the skin were of a pale and yellowish red. This gray, which coloured all the parts exposed to the light, changed when in the sun; and all the places of its body which were illuminated, instead of their blueish colour, became of a brownish gray, inclining to *minime*. The rest of the skin which was not illuminated by the sun, changed its gray into several brisk and shining colours, forming spots about half a finger's breadth, reaching from the crest of the spine to the middle of the back: others appeared on the ribs, fore legs, and tail. All these spots were of an Isabella colour, through the mixture of a pale yellow with which the granules were tinged, and of a bright red, which is the colour of the bottom of the skin which is visible between the granules: the rest of the skin not enlightened by the sun, and which was of a paler gray than ordinary, resembled a cloth made of mixed wool; some of the granules being greenish, others of a minime-gray, and others of the usual blueish gray, the ground remaining as before. When the sun did not shine, the first gray appeared again by little and little, and spread itself all over the body, ex-

cept under the feet, which continued of the same colour, but a little browner; and when, being in this state, some of the company handled it, there immediately appeared on its shoulders and fore legs several very blackish spots about the size of a finger nail, and which did not take place when it was handled by those who usually took care of it. Sometimes it was marked with brown spots, which inclined towards green. We afterwards wrapped it up in a linen cloth; where having been two or three minutes, we took it out whitish; but not so white as that of which Aldrovandus speaks, which was not to be distinguished from the linen on which it was laid. Ours, which had only changed its ordinary gray into a pale one, after having kept this colour some time, lost it insensibly. This experiment made us question the truth of the chameleon's taking all colours but white, as Theophrastus and Plutarch report; for ours seemed to have such a disposition to retain this colour, that it grew pale every night; and when dead, it had more white than any other colour: nor did we find that it changed colour all over the body, as Aristotle reports; for when it takes other colours than gray, and disguises itself, to appear in masquerade, as Ælian pleasantly says, it covers only certain parts of the body with them. Lastly, to conclude the experiments relative to the colours which the chameleon can take, it was laid on substances of various colours, and wrapped up therein; but it took not them as it had done the white, and it took

that only the first time the experiment was made, though it was repeated several times on different days.

" In making these experiments, we observed that there were a great many places of its skin which grew brown, but very little at a time: to be certain of which, we marked with small specks of ink those granules which to us appeared whitest in its pale state; and we always found that when it grew brownest, and its skin spotted, those grains which we had marked were always less brown than the rest."

M. d'Obsonville thinks it probable that the change of colour in the chameleon depends upon a mixture of blue and yellow, from which result the different shades of green: this opinion of his is founded on the appearance of the blood, and of the vessels which contain it. He tells us that the former is of a violet blue, and will preserve its colour for some minutes on linen or paper, if it has been previously steeped in a solution of alum; that the coats of the latter are yellow, as well in their trunks as their branches, and that consequently the mixture of the two will produce a green. But he proceeds further, and calls to his aid the passions of the animal to account for the different shades of this colour. Thus, when a healthy chameleon is provoked, the circulation is increased, and, being carried with violence from the heart to the extreme parts of the body, distends the vessels that are spread over the skin, and produces a superficial

blue green colour. On the contrary, says M. d'Obsonville, when this animal is a prisoner, impoverished, and deprived of the free use of air, the circulation being more languid, and the exterior vessels, of course, more empty, their colour prevails, and the chameleon changes to a yellow green, which lasts as long as it is confined.

From what Mr. Barrow has said in his African Travels, we conceive that the animal is principally indebted for these varied tints to the influence of oxygen. This gentleman observes, that "previously to the chameleon's assuming a change of colour it makes a long inspiration, the body swelling out to twice its usual size; and, as this inflation subsides, the change of colour gradually takes place. The only permanent marks are two small dark lines passing along the sides."

This power of inflating its body the chameleon is said to possess in an eminent degree: according to La Cepede, the inflation is produced by slow and irregular efforts; which, when long continued, extend the flaccid sides of the animal to double their usual size, and even swell the feet and tail. These efforts occasionally continue during two hours, increasing and diminishing at intervals. When the lungs are completely collapsed, and the air is evacuated from the body of the chameleon, it appears to consist of little more than skin and bone; and such is its wretched leanness, that the ribs, the vertebræ of the back, and all the tendons of its legs, may be distinctly seen and counted: in this state it

is said to resemble a mere animated skeleton covered with a skin.

In the conformation of this lizard a singularity occurs that is highly worthy of remark: the eyes, instead of having moveable eyelids, like other quadrupeds, are covered by a rough membrane, which is pierced in the middle with a small hole, not more than the tenth of an inch in diameter, through which is seen the pupil surrounded by an iris of a gold colour. This membrane is attached to the eye, and follows all its motions. The chameleon seems also to possess the power of moving one eye while the other is at rest, and of turning one forwards or upwards while the other is moved in a contrary direction; which must give it a decided advantage over other animals, since it can thus see on all sides at once. It is supposed that this wonderful structure is given the chameleon to defend those delicate organs from the intensity of the sun; and when we consider the artificial contrivance used by the Laplanders, and other northern nations, to defend their eyes from the excessive glare of the snow, by covering them with a thin board, having a narrow slit in the middle of it, we cannot deny our assent to the supposition. The tongue is another curiosity, somewhat resembling a common earth worm, and is from six to ten inches long. It terminates in a thick hollow knob, which is open, and resembles in some degree the end of an elephant's proboscis. The chameleon uses this uncommon apparatus with peculiar dexterity, darting it out with amazing quickness whenever it feels in-

clined to seize an insect, which never fails to adhere to the viscous humour that covers the tip of the tongue. The feet of this lizard are exceedingly curious, the toes being wrapped up in the skin so as to form two distinct bundles in each foot, something like the top of a crutch, one containing three toes and the other two: this contrivance is well adapted to the habits of the animal, and enables him to grasp the branch of a tree with great firmness. His tail likewise is well calculated to assist him in passing from tree to tree; since its flexibility allows the chameleon to twist it round the extremity of one branch, while he swings himself with safety to another.

Hasselquist describes a chameleon which he kept for near a month, as climbing up and down the sides of its cage in a very nimble and lively manner: but others, on the contrary, assure us that its motions are uniformly slow; and that, when climbing the large branches of trees, it is careful to fix its claws firmly into the bark, and move with the greatest caution. When walking on the ground it is said to step forward in a most careful manner, never lifting one foot till the others are properly placed.

This reptile's indolent manner, together with its very singular and extremely ugly appearance, seems only calculated to excite disgust; and nothing but the varied tints which the surface of its body occasionally presents to the eye of the spectator, could ever have called it into general notice, or have gained it the favour of the poets.

SALAMANDER.

SPECIFIC CHARACTER.

LACERTA SALAMANDRA.	L. cauda tereti brevi, corpore poroso, flavo nigroque vario. *Linn. Syst. Nat. Gmel.* 1. p. 1066.
	Tail short and round; body porous, without scales, and variegated with black and yellow.
	Lacerta cauda tereti brevi, pedibus inermibus, palmis tetradactylis, plantis pentadactylis. *Amœn. Acad.* 1. p. 131.
	SALAMANDRA TERRESTRIS. *Raj. Quadr.* 273.
SALAMANDER. . . .	*Seba Mus.* 2. pl. 15. f. 5. *Shaw Gen. Zool.* 3. p. 291. pl. 82.

THE many ridiculous stories which have originated respecting this innocent lizard are totally void of foundation, and scarcely deserve our notice. Far from remaining uninjured by fire, the salamander, when devoted to that element, will be as certainly destroyed as any other animal; but from its coldness, and a sort of milky fluid, which, when touched, it always secretes over the surface of its body, the activity of the fire is for a moment checked,

and the sufferings of the salamander prolonged: thus has a trifling circumstance in the natural history of this creature, been magnified into an ability to live in the midst of fire, and a power to quench it at pleasure.

The salamander is found in several parts of Europe, and generally inhabits moist and shady places: the cold, damp parts of thick woods, on elevated situations, or the sides of springs, seem particularly congenial to its nature. When the winter approaches, and the cold begins to set in, they retire in great numbers to their hiding-places, crowding together into the hollows of old trees, under the roots of hedges, or into subterranean retreats, where they remain, rolled up, till the spring returns and once more tempts them to come forth. The ground colour of the salamander is a deep shining black, variegated with large patches of bright orange colour. Two large glands are situated on each side of the head, towards the neck; and there are several open pores in different parts of the body, through which the before-mentioned milky fluid is exuded. The feet are entirely destitute of claws, and of course the animal is not, like other lizards, formed for climbing trees, but is doomed to crawl for ever upon the ground, and that in such a slow and languid manner that it seldom ventures far from its retreat. When we meet with an animal, like the salamander, the greater part of whose life is spent in holes, or under damp stones, in the most gloomy recesses it can meet with; who shuns the sun, and

seems to dread its heat; and who is only invited from its retreat by the appearance of rain; we are almost ready to suppose that it must drag on a miserable existence, without the shadow of an enjoyment. Its habits and its appetite are equally congenial; for the damp places to which it retires supply it with its principal food; beetles, snails, and earth-worms.

It is the opinion of M. La Cepede, among other naturalists, that the salamander is entirely devoid of hearing: this is founded on the want of openings to the ears, and of ability in the animal to articulate the slightest sound. Dumbness is generally connected with deafness; hence they suppose it incapable of communicating its sensations to other animals of the same species, and thus they account for its extreme stupidity. From being insensible to danger, it has acquired a reputation for courage, and is said constantly to keep its way, notwithstanding any attempts to terrify and turn it back.

This poor creature has been much abused on account of being malignant; but the accusation is without the slightest foundation, and probably originated in its unpleasant appearance, which too generally prepossesses us unjustly. On the contrary, it is with the utmost difficulty that the salamander can be made to open its mouth; and M. Maupertuis, in his experiments relative to its supposed poisonous nature, assures us, he was always obliged to open it by force. In this manner he

obliged the animal to wound some fowls and a dog; but the bite in no instance seemed to produce the smallest inconvenience. There is something remarkable, however, in the following fact. A dog and a turkey-cock swallowed some salamanders without the least injury; and yet when other lizards were made to bite this species and swallow some of the liquor which exudes from their pores, it constantly proved fatal.

The salamander is viviparous, and produces from fifteen to forty at a birth.

WATER-NEWT.

SPECIFIC CHARACTER.

LACERTA AQUATICA. . L. cauda teretiuscula mediocri. *Linn. Syst. Nat. Gmel.* 1. p. 1066.
Tail roundish and of a moderate length.
Salamandra alepidota, cauda teretiuscula. *Gronov. Mus.* 2. p. 78. no. 52.
TRITON CRISTATUS. *Laur. Amph.* p. 39. no. 44.
COMMON WATER-NEWT. *Shaw Gen. Zool.* 3. p. 298. pl. 83.

THIS animal has been confounded with the great water-newt by some naturalists, and both have been described under one head; they, however, appear to be distinct species, although their habits are the same. This little creature is well known to every one who has looked attentively for a few minutes on the surface of a pond, or hole filled with water, during the warm weather. They are seldom found in running streams, but may be seen in great numbers in stagnant water, frequently rising to the top to imbibe fresh air. They swim with great readiness, but are slow travellers upon land. In winter they retire to the bottom of deep drains in marshy

situations, or seek an asylum in some hole under ground, where they remain during the cold weather.

The common water-newts seldom exceed four inches in length: the male is at once distinguished from the female by an elevated membranous and sinuated crest, which runs along the back, and is continued to the very end of the tail. It is this part through which the circulation of the blood is so eminently conspicuous when viewed with a proper magnifying power. The ground colour of the male is olive brown, sprinkled with round black spots. The female is paler, and less distinctly spotted. Their food consists of worms and aquatic insects, and the prey is often contended for amongst them with great obstinancy. Dr. Townson kept some of them in a jar, and fed them with worms: the greatest possible stillness frequently prevailed among these little creatures before the food was given them; but the moment the worm was dropped into the water, all was bustle and confusion, each attacking the other indiscriminately, and seizing it by the head, foot, or tail. These battles were the more singular, as the object of their contention often lay for some time unnoticed at the bottom of the jar.

Almost all the lizard tribe change their skins once or twice a year; but the water-newt repeats this operation oftener, and the manner in which this change is effected has been particularly related by Baker, in the Philosophical Transactions

for the year 1747. He tells us, that a day or two before the change takes place the animal constantly becomes more inactive than usual, neglecting the worms which are given to it, though at other times it devours them greedily. The skin at different parts of the body appears loose, and of a less lively colour than before. At the appointed time for the performance of this great command of Nature, the animal begins to loosen the skin about its jaws with its fore feet, and continues to push it backward in a very gradual manner till it is able to slip out first one leg and then the other. When this is done, it proceeds to thrust the skin backwards as far as these legs can reach; but is obliged to assist itself by rubbing against pebbles, gravel, or any rough substance it can meet with, till it is more than half freed from its skin, which it thus contrives to turn inside out over the hinder part of the body and tail. When the business is so far completed, the water-newt turns its head round towards the tail, and, taking the loose skin in its mouth, sets its feet firmly upon it, and by degrees drags it completely off; the hind legs being extricated by this proceeding in the same manner as the fore legs were before.

When the cast skin is examined, it will be found completely inverted, but without the smallest hole or rent. The part which covered the hind legs resembles a glove that has been turned without pulling out the tips of the fingers, while that which covered the fore legs remains within the skin. In

this operation the water-newts differ from snakes, in not putting off the skin of their eyes; for we may always observe two little holes in the skin where the eyes have been. Mr. Baker says, it is very entertaining to observe the animal while engaged in this necessary work, which sometimes takes near half an hour to complete, and leaves the little creature full of life and vigour, as well as very sleek and beautiful. The cast skins may be frequently observed floating on the surface of stagnant water.

Mr. Baker, who made his observations on some of these reptiles kept in a large jar, informs us that if the cast skin is not soon removed it is very common for the newt to swallow it whole; and if it begins with the head part, which is generally the case, the tail, being filled with air and water, becomes like a blown bladder, and proves so unmanageable that it is very diverting to see the pains it costs the animal to reduce it to a condition fit to be got down its throat.

The eggs of this species are deposited in a viscid substance which connects them all together; and, as they increase in size, the young newts may be fairly seen inclosed in a fluid and coiled up within a transparent membrane. When the young first escape from their confinement, their shoulders are furnished with fringed tufts, like feathers, which serve the purpose of fins, and which are gradually obliterated as the animal grows larger.

Water-newts are very tenacious of life, and have

been found imbedded in ice, where they had probably remained in a torpid state for a considerable time, and yet recovered when the ice dissolved. They are likewise said to possess a reproductive power, and to renew different parts of their bodies which have, by accident or design, been separated from them.

RATTLE-SNAKE.

GENERIC CHARACTER.

Body covered with scales, and terminated by a rattle.

SPECIFIC CHARACTER.

CROTALUS HORRIDUS. . C. fusco-flavescens, fasciis transversis nigricantibus.

Yellowish brown rattle-snake, with blackish transverse bands. *Shaw Gen. Zool.* 3. p. 317. pl. 88.

Crotalus horridus. Scutis 167; scutellis 23. *Linn. Syst. Nat. Gmel.* 1. p. 1080.

Crotalus maculis trigonis fuscis. *Bodd. Nov. Act. Ac. Cæs.* 7. p. 16. no. 1.

CAUDISONA TERRIFICA. *Lau. Amph.* 1. p. 93. no. 203.

BANDED RATTLE-SNAKE. *Seb. Mus.* 2. t. 95. f. 1. BOIQUIRA. *Kerr's La Cepede* 4. p. 245. pl. 9. f. 1. *Catesb. Car.* 2. pl. 41.

FORTUNATELY for mankind, these very dangerous reptiles are by no means so active as the rest of their tribe: they have not the power of springing upon the assailant, and have besides a rattle in the

tail which warns the incautious traveller of their approach. We were unacquainted with this snake till the discovery of America introduced it to our notice, in whose extensive woods, and chalky uncultivated grounds, abundance of them are to be met with. Their general length is from three to five feet, though they sometimes exceed that measure, and Catesby mentions one which was eight feet long, and weighed between eight and nine pounds; but this was of an extraordinary size, and confessedly the largest he ever saw. The effect of their bite is almost instantaneous; and the poison runs so rapidly through the body, that a dog, which was bitten by one of these serpents in full vigour, immediately became convulsed, and died in less than a quarter of a minute, with his lips drawn up so as to leave his teeth and gums bare. The effect of the poison, however, is not so instantaneous when the bite is soon repeated; as a second dog was bitten by this snake half an hour after the first, and although he was violently sick and was attacked with convulsions, he was nearly two hours in dying. This cruel experiment was repeated upon a third dog, after an interval of an hour; but the venom had lost so much of its activity, that the poor animal languished till the next day before he died. All poisonous serpents are provided with similar weapons, and inject their venom in the same manner: therefore the description we have given of the fangs of the viper, will apply to this and every other venomous species.

The animal is thus described in a general way by Catesby: "The colour of the head of this rattle-snake is brown, the eye red, the upper part of the body of a brownish yellow, transversely marked with irregular broad black lists. The rattle is usually of a brown colour, composed of several horny membranous cells, of an undulated pyramidal figure, which are articulated one within another, so that the point of the first cell reaches as far as the basis or protuberant ring of the third, and so on; which articulation being very loose, gives liberty to the parts of the cells that are inclosed within the outward rings to strike against the sides of them, and so to cause the rattling noise which is heard when the snake shakes its tail."

When they pass from one place to another they glide slowly along with the head close to the ground, and in this manner they sometimes enter houses unperceived by the inhabitants; a remarkable instance of which is mentioned by Catesby, who was residing in the house of Colonel Blake, of Carolina, and had just left his bed-room, when the maid, on turning down the sheets, discovered a rattle-snake coiled up in the middle of the bed. Some time before this happened, one of these reptiles, about eight feet long, was sliding into the same gentleman's house; where he would probably have concealed himself if the family had not been alarmed by the repeated outcries of the hogs, dogs, and poultry, who, says Catesby, seemed all united in their hatred against him, showing the greatest

consternation by erecting their bristles and feathers; they surrounded him, and expressed their wrath and indignation, but carefully kept their distance, while he, regardless of their threats, glided slowly along.

Notwithstanding the venomous nature of these snakes, and the abhorrence in which they are held by other animals, it is said that the hogs in America will feed greedily upon the dead ones, and even attack the living, seizing them by the neck so as to prevent their biting, and then devouring them. When they are either irritated or alarmed, they coil themselves into a circle with the head erect in the centre, and their eyes flaming in a most terrific manner: but they are never the aggressors, says Catesby, except in what they prey upon; for they have no inclination to bite unless they are disturbed, and then the notice they give by shaking their rattles, and their want of agility, make it easy for the traveller to avoid them: however, in wet weather, when their rattles give but little sound, they are more to be feared; and on this account the Indians decline travelling in the woods in the rainy season, lest they should be bitten before they are aware of their danger. The following instance will serve to show that their poison, though very terrible in its effects, is not always certain death. A gentleman in Virginia accidentally trod upon a rattle-snake, which so enraged the animal that it bit him in his hand. The gentleman, though aware of his danger and the necessity of immediate assistance, stopped

to kill the snake, which he carried home, and, throwing it upon the ground, told them that he was killed, and that the snake was his murderer. In such an extremity no time was to be lost, and olive oil, the remedy nearest at hand, was immediately applied to. His arm, which was beginning to swell, was tied up near the shoulder, and the wound well rubbed with the oil. By the help of this application, and every other that could be thought of, a stop was put to the infection, and his constitution so far got the better of the poison that he at length recovered; but not without feeling the most various and dreadful symptoms for several weeks together. The gentleman, who wrote this account himself to Mr. Collinson, says, that his arm below the ligature appeared of many colours, with a writhing among the muscles, which to his terrified imagination appeared like the motions of a snake under the skin. After the swelling of his arm had considerably subsided, he was attacked by a fever, attended with delirium and great weakness; from all which, however, he recovered, though he tells us that his hand and arm were covered with spots, which continued all the summer.

The Indians sometimes succeed, in slight cases, by sucking the wound: they consider this method as very successful, but at the same time tell you, very gravely, that the person who is thus recovered will annually feel the pains return at the time he was bit. Among the remedies which they chiefly rely on, according to Catesby, and which most of

the Virginian and Carolina Indians carry dry in their pockets, is a small tuberous root which they procure from the distant parts of the country. They chew a portion of this, and having swallowed some of the juice apply the rest to the wound. "Having by travelling much with the Indians," continues Catesby, "had frequent opportunities of seeing the direful effects of the bites of these snakes, it always seemed, and was apparent to me, that the good effect usually attributed to these their remedies, is owing more to the force of nature, or the slightness of the bite of a small snake in a muscular part, &c. The person thus bitten I have known to survive without any assistance for many hours; but where a rattle-snake with full force penetrates with his deadly fangs, and pricks a vein or an artery, inevitable death ensues, and that, as I have often seen, in less than two minutes. The Indians know their destiny the moment they are bit; and, when they perceive it mortal, apply no remedy, concluding all efforts in vain: if the bite happeneth in a fleshy part they immediately cut it, to stop the current of the poison."

Rattle-snakes are viviparous, and bring forth about twelve young. In the month of August they are said to be most dangerous, but never attack mankind unless they are provoked; and this attack is always preceded by the noise of their rattle, which, when they are pleased, is far from being distinct. They feed on squirrels, lizards, frogs, and other small animals; for which purpose they

sometimes frequent the sides of rills, and sometimes mount the trees. Multitudes of them collect together in the winter, and hide themselves beneath the ground out of the reach of the frost. In the spring, when they first appear, they are so weak and languid that they may be easily killed.

Much has been said respecting the fascinating powers of the rattle-snake, and authors of considerable credit have fully believed these animals capable of so intimidating their prey as to force them to run into their mouth. As we have had no opportunity of ascertaining this point ourselves, we shall merely relate what some others have said upon the subject, and leave the reader to make his own comments upon it.

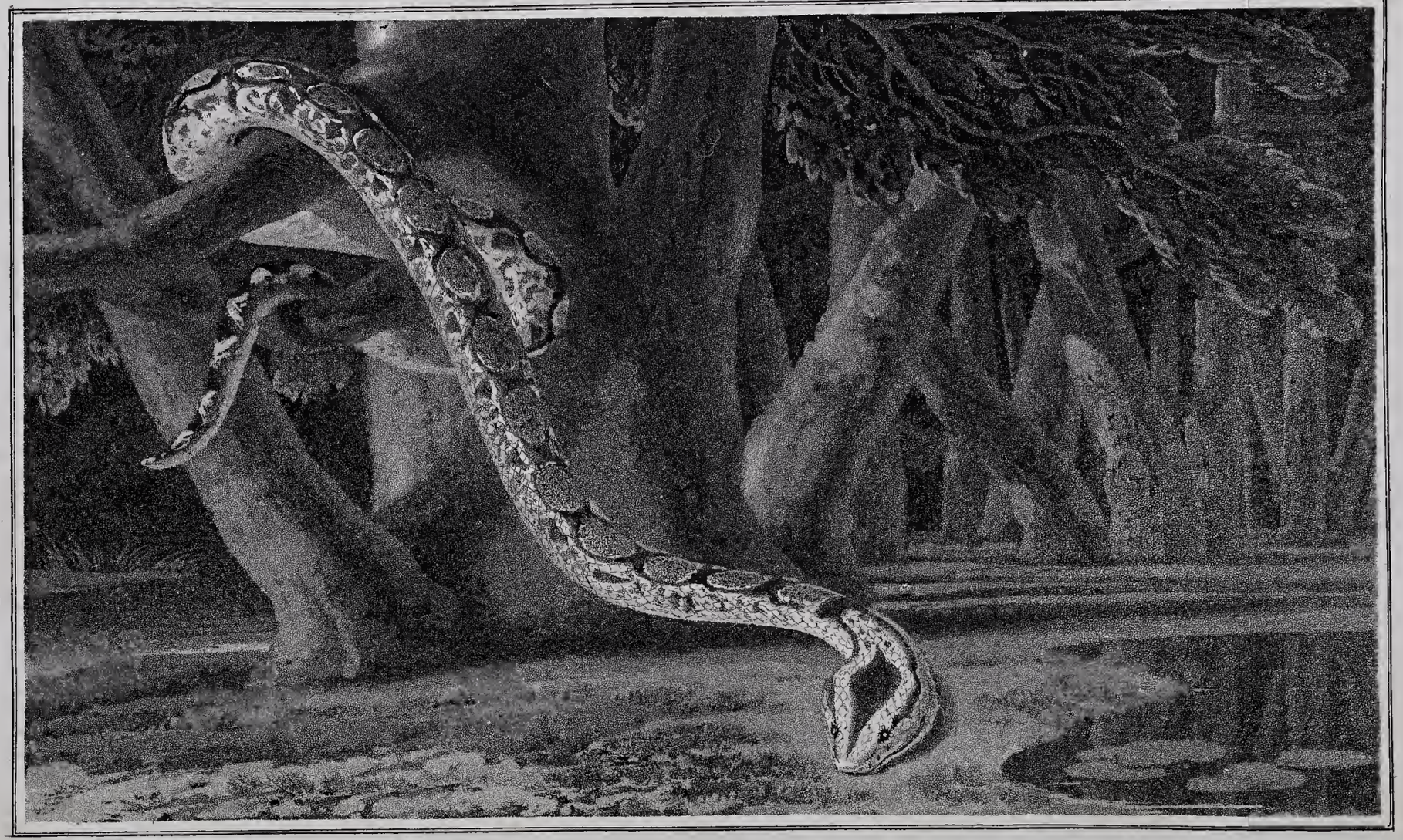
" The charming," says Catesby, " as it is commonly called, or attractive power this snake is said to have, of drawing to it small animals, and devouring them, is generally believed in America: as for my own part, I never saw the action; but a great many from whom I had it related, all agree in the manner of the process; which is, that the animals, particularly birds and squirrels, (which principally are their prey,) no sooner spy the snake than they skip from spray to spray, hovering and approaching gradually nearer to the enemy, regardless of any other danger; but with distracted gestures and outcries descend, though from the top of the loftiest trees, to the mouth of the snake, who openeth his jaws, takes them in, and in a moment swallows them."

Mr. Pennant quotes Kalm for a similar account, and describes the snake as lying at the bottom of a tree on which a squirrel is seated. His fiery eyes are stedfastly fixed upon the little animal, who becomes greatly agitated, and immediately begins a most piteous outcry. This cry, it seems, is so peculiar, and so well known to the Indians, that whenever they hear it, they are certain a snake is present. The unhappy squirrel runs repeatedly part of the way up and down the tree, at each turn coming lower, till at last it leaps down to the snake, and with the most lamentable cries runs into his jaws, which are already wide open for its reception. During the whole of the process the snake continues at the bottom of the tree with his eyes fixed on the squirrel; with which his attention is so engrossed, that a considerable noise may be made by a person accidentally passing, without at all diverting him from his object.

The fascinating power does not seem to belong exclusively to the rattle-snake, since Le Vaillant, in his new Travels into the Interior of Africa, assures us, that he saw a bird on the branch of a tree, trembling as if in convulsions; and a large species of snake on another branch about four feet distant, on which it was lying with outstretched neck and fiery eyes, gazing steadily at the poor animal. The bird was apparently denied the power to escape, and seemed in great agony. One of the party killed the snake, and found that the bird was also dead. They attributed its death en-

tirely to fear, as they could not discover the slightest wound. Some time after this, a mouse which was alarmed by the same cause died in his hand after the snake was frightened away.

Mr. Barton, professor of natural history in the university of Pennsylvania, has written a memoir upon this subject; and after having examined the question with some care, he is of opinion that snakes have no particular fascinating property, and that the idea has probably originated in the anxious care of the old birds for the protection of their nests and young, who are themselves occasionally caught by the rattle-snake, while they are fluttering to divert his attention from their brood.



GREAT BOA.

Designed by W. Daniell.

Published by Messrs Cadell & Davies, London March 1 1807.

GREAT BOA.

GENERIC CHARACTER.

Body covered with scales; those under the abdomen and beneath the tail undivided.

SPECIFIC CHARACTER.

BOA CONSTRICTOR. B. griseo-flavescens, catena dorsali castanea, maculis lateralibus subtrigonis.

Yellowish gray, with a large chestnut-coloured chain-like pattern down the back, and subtrigonal spots on the side. *Shaw Gen. Zool.* 3. p. 337. pl. 92.

Boa maculis variegatis rhombeis. *Boddaert Nov. Act. Ac. Cæs.* 7. p. 18. no. 5.

Serpens Americana arborea. *Seb.* 1. pl. 53.

CONSTRICTOR BOA. *La Cepede Ovip. Quadr.* 4. p. 190. pl. 7. fig. 1.

GREAT BOA. . . *Nat. Misc.* 2. pl. 51.

THIS most formidable serpent frequently measures from twenty to thirty, and even thirty-five feet in length. It far exceeds every other species in size, as well as in strength and beauty. The ground colour of the animal, in the younger specimens, according to Dr. Shaw, is a yellowish gray. A series of large chain-like reddish brown variegations are

continued along the back, and between them many smaller ones of no particular form; the ground colour is likewise scattered over with reddish brown specks. In the larger animals of this species the colours are not so vivid, but mix with each other, and assume a more uniform gray cast; the reddish brown variegations sink into a deep chestnut.

It was this enormous creature that so alarmed the Roman army when led by Regulus into Africa. It appears from Livy, that several soldiers had been swallowed by it, and many pressed to death in the spiral volumes of its tail; that it had taken its station on the banks of the Bagrada, and that it kept the whole Roman army from coming to the river. It was killed at last by large stones slung from military engines, and then exhibited a sight more terrible to the Roman cohorts and legions, than even Carthage itself. Pliny says that the skin, which was sent to Rome and deposited, together with the jaw-bone, in one of the temples, was to be seen till the time of the Numantine war.

The boa is not confined to Africa, but is likewise a native of India and South America, where its amazing strength is acknowledged; and well attested facts have proved it capable of engorging an animal much larger than itself: thus, we are told of goats, deer, and even cattle, which have been swallowed by this creature, who previously crushes their bones with its body. The accounts of travellers who have penetrated the torrid regions, where

the boa attains its largest size, are really alarming. They describe it as resembling the trunk of a large tree moving swiftly along among the bushes and high grass, and leaving a large furrow which follows all the undulations of its course. All the animals on which it preys fly before it; and the only means to avoid the pursuit is to set fire to the grass, which immediately spreads, and checks the ardour of the serpent. We should naturally conclude that an animal of such amazing power, and of so terrific an appearance, would carefully be avoided by all mankind; yet the contrary appears to be the case: for we are assured that the negroes, when properly armed, will frequently attack and destroy it. Captain Stedman, during his residence in Surinam, assisted by his negro, was bold enough to shoot one which measured twenty-two feet and some inches, although the natives declared it to be a young one. As the account the captain has given of the transaction is interesting, we shall relate it nearly in his own words.

As Captain Stedman was resting in his hammock, while the vessel which he was in floated down the river, the sentinel told him he had seen and challenged something black and moving in the brushwood on the beach which gave no answer; but which from its size he concluded must be a man. The captain immediately manned the canoe which accompanied his vessel, and rowed on shore to ascertain what it was; when, to his great surprise, one of his slaves declared it was no negro, but a

large amphibious snake, and that he might shoot it if he pleased. To this, however, it seems Stedman had not the least inclination, and therefore ordered all of them to return on board. The negro then begged leave to step forward and shoot it himself, as he was certain it could not be far off, and assured his master that there was no danger. "This declaration," says the captain, "inspired me with so much pride and emulation, that I determined to take his first advice and kill it myself; provided he would point it out to me, and be responsible for the hazard, by standing at my side; from which I swore that if he dared to move, I should level the piece at himself, and blow out his own brains.

"To this the negro cheerfully agreed, and having loaded my gun with a ball cartridge, we proceeded; David cutting a path with a bill hook, and a marine following with three more loaded firelocks to keep in readiness. We had not gone above twenty yards through mud and water, the negro looking every way with an uncommon degree of vivacity and attention, when, starting behind me he called out, 'Me see snakee!' and in effect there lay the animal, rolled up under the fallen leaves and rubbish of the trees; and so well covered, that it was some time before I distinctly perceived the head of this monster, distant from me not above sixteen feet, moving its forked tongue, while its eyes, from their uncommon brightness, appeared to emit sparks of fire. I now rested my piece upon a branch, for the purpose of taking a surer aim,

fired; but missing the head the ball went through the body, when the animal struck round, and with such astonishing force as to cut away all the underwood around him with the facility of a sythe mowing grass, and, by flouncing his tail, caused the mud and dirt to fly over our heads to a considerable distance. Of this proceeding, however, we were not torpid spectators, but took to our heels and crowded into the canoe. The negro now entreated me to renew the charge, assuring me the snake would be quiet in a few minutes, and at any rate persisted in the assertion that he was neither able nor inclined to pursue us; which opinion he supported by walking before me, till I should be ready to fire. And thus I again undertook to make the trial, especially as he said that his first starting backwards was only to make room for me. I now found the snake a little removed from his former station, but very quiet, with his head, as before, lying out among the fallen leaves, rotten bark and old moss. I fired at it immediately, but with no better success than the other time; and now, being but slightly wounded, he sent up such a cloud of dust and dirt as I never saw but in a whirlwind, and made us once more suddenly retreat to our canoe; where now, being heartily tired of the exploit, I gave orders to row towards the barge: but David still entreating me to permit *him* to kill the animal, I was, by his persuasions, induced to make a third and last attempt, in company with him. Thus, having once more discovered the snake, we discharged both our pieces

at once, and with this good effect, that he was now by one of us shot through the head."

The captain with the help of his servants now secured the snake, by passing a rope with a running noose upon it over his head: this was effected with some difficulty, as the animal, notwithstanding his being mortally wounded, still continued to writhe and twist about, in such a manner as to render it dangerous for any person to approach him. In this state he was dragged to the shore, and the end of the rope made fast to the canoe, in order to tow him to the vessel: according to Stedman's account, he continued swimming like an eel till they arrived on board; where, upon due consideration, it was agreed to convey this immense snake once more on shore, and have him skinned for the sake of the oil. In order to effect this purpose, the negro David, having climbed up a tree with the end of the rope, let it down over a strong forked bough, and the other negroes hoisted up the snake, and suspended him from the tree. This done, David, with a sharp knife between his teeth, now left the tree, and clung fast upon the monster, which was still twisting, and began his operations by ripping it up, and stripping down the skin as he descended. "Though I perceived," continues Stedman, "that the animal was no longer able to do him any injury, I confess I could not without emotion see a man stark naked, black and bloody, clinging with arms and legs round the slimy and yet living monster. This labour, however, was not without its use, since

he not only dexterously finished the operation, but provided me, besides the skin, with above four gallons of fine clarified fat, or rather oil, though there was wasted perhaps as much more."

The adventure was finally concluded by the negroes, who cut the flesh of the snake into pieces on purpose to dress it; from which they were deterred by the captain, who would not allow them to eat such disgusting food, notwithstanding they declared it was exceedingly good and wholesome.

This monstrous snake, when he has fasted for any length of time, becomes most actively voracious, and springs upon the unfortunate animal who comes within his reach with inconceivable rapidity. However large the creature may be, his doom is fixed, and the power of flight denied him. He is confined within the folds of the snake's enormous tail, who, contracting the muscles of his body in proportion to the resistance to be overcome, crushes the wretched victim in pieces, and then, covering the carcase with saliva, sucks it by degrees into his stomach. In this manner one of the largest of the species has been said to manage a buffalo; and we are shocked to add, that there is an instance upon record of a human being who fell a sacrifice to one of these monsters. A man belonging to a Malay prow, which anchored for the night close to the island of Celebes, went on shore to look for betel nut, and on his return is supposed to have gone to sleep upon the beach. In the middle of the night his screams were heard by

the people in the vessel, who immediately went on shore: but alas! they came too late, their comrade was crushed to death by a monstrous snake; and all the satisfaction they could derive, was to revenge his death by killing his enemy, whose head they cut off, and carried it, together with the body of the man, on board their boat. The marks of the fangs were imprinted upon the man's right wrist, and the corpse, though disfigured, bore evident signs of being crushed by the monster's twisting himself round the head, neck, breast, and thigh. The snake measured about thirty feet; and when the jaws were extended they admitted a body the size of a man's head.

When these animals have swallowed their prey, they may be approached without fear, as they for some time afterwards lose all ability to move, and lie as it were in a kind of torpor. They have been known to remain in this state for five or six days, till the food they have ingorged is digested, and they are in a condition to seek for more.

The antient Mexicans are said to have held the great boa in religious veneration. They distinguished it by a name signifying emperor, or powerful. All its motions were watched with great attention, and its long and violent hissings were heard with universal consternation: some public calamity was expected to follow these warnings, which were considered as immediately connected with their destiny.

SNAKE.

GENERIC CHARACTER.

Body covered with scales; those under the tail alternate.

VIPER.

SPECIFIC CHARACTER.

Coluber Berus. C. cinereus, macula capitis biloba, vitta dorsali atra dentato-repanda.

Cinereous Viper, with a bilobated spot on the head, and a black flexuous or zigzag band down the back. *Shaw Gen. Zool.* 3. p. 365. pl. 101.

Coluber Berus, scutis abdom. 146, squamis caudæ 39. *Faun. Suec.* no. 286.

Common Viper. *Penn. Brit. Zool.* 3. p. 26. no. 12. pl. 4. *La Cepede Ovip. Quadr.* &c. 3. p. 175. pl. 1. fig. 1.

We ought to be very thankful that, while the tropical countries abound with venomous serpents whose bite is almost certain death, there is only one animal in Great Britain from whose poison we have any thing to fear. The viper is found in many parts of this island, particularly in chalky countries, where they are sometimes seen in considerable

numbers. The general length of the viper is about eighteen inches or two feet, though they are occasionally met with rather longer. We are taught to distinguish it from the common snake by the head, which is larger, and particularly by the tail, which does not taper to so great a length. We must acknowledge the kindness of Providence towards us, in limiting the numbers of this noxious reptile. They are far from being prolific, seldom above eleven eggs being found in one viper, and those as it were chained together, and each about the size of a blackbird's. The young are excluded alive towards the end of the summer, and the female is supposed to go about three months before she brings forth. Each egg contains from one to four young ones, which at the appointed time burst the shell, and when grown to a proper size creep from their confinement into the open air. "On the fourth of August 1755," says Mr. White, "we surprised a large female viper, which seemed very heavy and bloated, as it lay on the grass, basking in the sun. When we came to cut it up, we found that the abdomen was crowded with young, fifteen in number; the shortest of which measured full seven inches, and were about the size of full-grown earth-worms. This little fry issued into the world with the true viper spirit about them, showing great alertness as soon as disengaged from the body of the dam; they twisted and wriggled about, set themselves up, and gaped very wide when touched with a stick, showing manifest tokens of menace and defiance,

though as yet they had no manner of fangs that we could find, even with the help of our glasses."

The apparatus with which the viper gives the deadly wound, consists, as in other poisonous serpents, of two teeth or fangs seated in the upper jaw. These teeth are moveable, and are generally laid flat along the jaw; but whenever the animal is inclined to bite they are instantly erected, and ready to inflict the mortal wound. Each fang is hollow throughout its length, and the lower end of the canal opens into a little bladder of venom, situated under the muscle of the upper jaw: when this muscle is put in action it compresses the bladder, and forces the poison through the tooth into the wound.

From the experiments of Francini, related in the Philosophical Transactions, we learn that the venom of the viper is quickly fatal to small animals. Two pigeons were wounded by the fangs of a viper, whose head had been previously cut off. The wound was made by thrusting the fangs into the fleshy part of the pigeon's breast, and pressing the poison through them from the bladders where it is secreted. The pigeon thus bitten began to stagger immediately, and died in a few minutes. The second was wounded in the same part and expired in the same manner, but was rather longer in dying. A viper was then irritated so as to bite a cock in both his thighs; in consequence of which he died in a quarter of an hour. These experiments were repeated, and others tried with a similar result, so

that the activity of the poison was sufficiently proved. Nevertheless its fatal effects are not so sudden upon the larger animals, and much seems to depend upon the vigour of the creature, the season of the year, and the part bitten. When vipers were commonly used by the faculty, it is a known fact that the persons who were employed to catch them were frequently wounded, and that the application they always used was salad oil: with this about them they felt secure, and would even suffer themselves to be bitten on purpose to prove the remedy. The case of William Oliver, related in the Philosophical Transactions, is a singular instance of the reliance which these people placed in their oil. This man was a viper-catcher at Bath, and is said to have been the first who discovered this admirable remedy. On the first of June 1735, in the presence of a great number of persons, he suffered himself to be bitten by an old black viper, upon the wrist and joint of the thumb of the right hand; he immediately felt a violent pain, which extended from his thumb up his arm, even before he could disengage the viper from his hand. In a few minutes after he complained of a burning pain which trickled up his arm: soon after this his eyes watered excessively, and began to look red and fiery, and in less than an hour he felt the venom reach his heart, where it caused a pricking pain attended with faintness, shortness of breath, and cold sweats: these alarming symptoms were succeeded by a swelling of the belly, with intense gripings

and pains in the back, attended with violent evacuations; during which his sight failed him for several minutes, but he never lost his hearing. He said, that in his former experiments he had always used the remedy when he found that the venom was reaching his heart; but this time, being willing completely to satisfy the company, and trusting entirely to the beneficial quality of his olive oil, he forbore to apply it till he found himself exceedingly ill and quite giddy. About an hour and a quarter after he had been bitten, a chafing-dish of glowing charcoal was brought in, and his naked arm held over it as near as he could bear, while his wife rubbed in the oil with her hand, turning his arm continually round, as if she would have roasted it over the coals: he said the poison abated, but the swelling was not much diminished. This operation was succeeded by most violent purgings and vomitings, and his pulse became so low and irregular, that it was thought proper to administer some cordial remedies: from these, however, he received no benefit; but a glass or two of olive oil, which he took soon after, seemed to give him ease. He was put to bed in this dangerous state; where his arm was again bathed over a pan of charcoal, with heated salad oil, by the direction of Dr. Mortimer, who was the attending physician. This last operation acted like a charm, and he declared that he found immediate relief; soon after this he fell into a profound sleep, in which he remained nine hours, and

awoke perfectly well; but in the afternoon, on drinking too freely of rum and strong beer, the swelling returned, with much pain and cold sweats: these symptoms, however, were soon removed on repeating the remedy, and wrapping the limb up in brown paper soaked in oil.

The same William Oliver presented the Royal Society with a female viper big with young, which was kept alive in common green moss, in a box with a glass cover. She brought forth several young ones, who slipped off their skins, and the outward membrane of their eyes along with them, about six weeks after their birth. They were observed, first to loosen the skin about the mouth, and then slip it off backwards by wriggling themselves through the entanglement of the moss.

The motion of these reptiles is very slow when compared with other snakes, nor can they twist themselves about so readily, being only able to turn the head with any agility. They never attack mankind, or any large animal, unless he first becomes the aggressor, by trampling upon them; then indeed they are justly irritated, and frequently bite severely. The viper-catchers are not at all afraid of them, as they very well know how to seize the creatures so as to prevent their biting. Some for this purpose use a forked stick, by which they fix the viper by the neck, and then throw it into a bag. Others, holding down its head with the end of a stick, pinch its neck with the left hand, and, while the animal

tries to defend itself, with its mouth wide open, extract the poison fangs; after which it may be handled with perfect safety.

The viper-catchers no longer receive that encouragement from the faculty, which they did in those days when the flesh of this reptile was considered as a restorative and strengthening diet, while the fat was extolled for many virtues. The Greek physicians prescribed the flesh for the cure of leprous disorders, and Galen recommended it to those who were afflicted with elephantiasis. In modern times it has received its share of praise; and the French, as well as ourselves, have placed great faith in viper broth and viper wine.

CERASTES.

SPECIFIC CHARACTER.

COLUBER CERASTES. C. subferrugineus, maculis distantibus subovatis subtransversis fuscis, palpebris cornutis.

Subferruginous snake, with distant subovate subtransverse brown spots, and horned eyelids. *Shaw Gen. Zool.* 3. p. 385. pl. 103.

COLUBER CERASTES. Scutis 150, scutellis 25. *Linn. Syst. Nat. Gmel.* 1. p. 1087.

COLUBER CORNUTUS. *Hasselq. It.* p. 315. no. 61.

CERASTES. . . . *Bruce's Travels,* oct. ed. v. 7. p. 292.

THIS venomous serpent is a native of Egypt, as well as of Syria and Arabia. It was respected by the antient Egyptians, and placed among their sacred symbols, where its figure may, to this day, be traced on the columns of their temples, the walls of their palaces, &c. The cerastes is at once distinguished from other snakes by two small, pointed, and curved horns, situated over the eyes; these little appendages give the animal a very terrific appearance, though they are not offensive weapons. Mr. Bruce,

in his admirable figure of this creature, has drawn the horns rather pointing forwards. The usual length of the cerastes is said to be from twelve to fifteen inches, though they occasionally extend to two feet. The colour on the back is yellowish, with a few irregular oblong spots of a deeper shade; the under surface of the body is of a pale lead colour.

If the account which Shaw has given of this serpent, in the second volume of his Travels, be correct, it is able to endure a much longer fast than any of its fellow-creatures. He assures us, that one Gabrieli, an apothecary at Venice, who had resided for some years at Cairo, kept two cerastes in a well closed bottle for five years without any food. A little sand was put with them into the bottle, in which they burrowed; and at the time our author saw them they were changing their skins, and, according to his account, seemed as full of vigour as if but lately taken.

An object so common in Egypt, and so well known to its inhabitants, could not escape the notice of Mr. Bruce; accordingly we find in his Travels a very full description of the animal and its manners, illustrated by a well engraved plate, which has been considered as perfectly correct by one of the first naturalists in this country. Mr. Bruce informs us, that the cerastes chiefly inhabit the desert and sandy part of the eastern continent; that they abound in the three Arabias, and in Africa; and that

he never saw so many of them as in the Cyrenaicum, where the jerboa is frequent in proportion. They are so fond of heat, that, when our traveller and his companions made a fire at night in order to dress their victuals, they were generally visited by more than half a dozen of these vipers, who burnt themselves to death by approaching the embers. To prove the venomous nature of the cerastes, Mr. Bruce compelled one of them to scratch eighteen pigeons upon the thigh, and they all died nearly in the same interval of time. This gentleman, likewise, in some measure corroborates the account of Dr. Shaw respecting their abstinence. He tells us that he kept two snakes of this species in a glass jar, such as is used for keeping sweetmeats in, for two years, without any food; they did not sleep, that he observed, in winter, but cast their skins the last days of April.

The following singular account, by Mr. Bruce, of the manners of the cerastes, and the different effect of its venom, we shall beg leave to subjoin in the words of the author. "The cerastes moves with great rapidity, and in all directions, forward, backward, and sideways. When he is inclined to surprise any one who is too far from him, he creeps with his side towards the person, and his head averted, till, judging his distance, he turns round, springs upon him, and fastens upon the part next to him; for it is not true what is said, that the cerastes does not leap or spring. I saw one of them

at Cairo, in the house of Julian and Rosa, crawl up the side of a box, in which there were many, and there lie still as if hiding himself, till one of the people who brought them to us came near him, and though in a very disadvantageous posture, sticking, as it were, perpendicular to the side of the box, he leaped near the distance of three feet, and fastened between the man's fore finger and thumb, so as to bring the blood. The fellow showed no sign of either pain or fear, and we kept him with us full four hours without his applying any sort of remedy, or his seeming inclined so to do. To make myself assured that the animal was in its perfect state, I made the man hold him by the neck, so as to force him to open his mouth, and lacerate the thigh of a pelican, a bird I had tamed, as big as a swan. The bird died in about thirteen minutes, though it was apparently affected in fifty seconds; and we cannot think this was a fair trial, because, a few minutes before, it had bitten the man, and so discharged part of its virus; and it was made to scratch the pelican by force, without any irritation or action of its own."

The inhabitants of the East will handle venomous reptiles with a freedom which an European will hardly credit upon mere report: yet we have been assured, from the most respectable authority, that for the sake of a sorry livelihood the Hindoos carry them about in baskets to show the idle multitude, and make them gradually uncoil themselves to the

sound of their rough music. Not only the innoxious species are subjected to their will, but even the deadly cobra de capello * is obliged to bend, and show itself to please its master. It has been long supposed that these people have some physical means of securing themselves against the bite of venomous serpents; and the following account, if we may rely upon it, seems to confirm this opinion.

"I can myself avouch," says Mr. Bruce, "that all the black people in the kingdom of Sennaar, whether Funge or Nuba, are perfectly armed against the bite of either scorpion or viper. They take the cerastes in their hands at all times, put them in their bosoms, and throw them at one another as children do apples or balls, without having irritated them by this usage so much as to bite. The Arabs have not this secret naturally; but from their infancy they acquire an exemption from the mortal consequences attending the bite of these animals, by chewing a certain root, and washing themselves with an infusion of certain plants in water. One day, while I was sitting with the brother of Shekh Adelan, prime minister of Sennaar, a slave of his brought a cerastes, which he had just taken out of a hole, and was using with every sort of familiarity. I told him my suspicion that the teeth had been drawn; but he assured me they were not, as did his master Kitton, who took

* See the account of that serpent.

it from him, wound it round his arm, and at my desire ordered the servant to carry it home with me. I took a chicken by the neck, and made it flutter before him; his seeming indifference left him, and he bit it with great signs of anger: the chicken died almost immediately. I say his seeming indifference, for I constantly observed that, however lively the viper was before, yet, upon being seized by any of these barbarians, he seemed as if taken with sickness and feebleness, frequently shut his eyes, and never turned his mouth towards the arm of the person that held him. I asked Kitton how they came to be exempted from this mischief. He said they were born so; and so said the grave and respectable men among them. Many of the lighter and lower sort talked of enchantments by words and by writing; but they all knew how to prepare any person by medicines, which were decoctions of herbs and roots. I have seen many thus armed for a season do pretty much the same feats as those who possessed the exemption: the drugs were given me, and I several times armed myself, as I thought, resolved to try the experiment; but my heart always failed me when I came to the trial; because among these wretched people it was a pretence they might very probably have sheltered themselves under, that I was a Christian, and that therefore it had no effect upon me. I have still remaining by me a small quantity of this root, but never had an opportunity of trying the experiment."

Mr. Bruce has laboured to prove that the aspic with which Cleopatra killed herself was no other than the cerastes; but as this point must for ever remain a matter of conjecture, we shall leave the subject to be discussed by those who have leisure and inclination to pursue it.

COBRA DE CAPELLO.

SPECIFIC CHARACTER.

COLUBER NAJA. C. ferrugineo-flavescens, collo supra macula magna conspicillata albo nigroque varia notata.

Ferruginous-yellow Snake, with the neck marked above by a large black and white spectacle-shaped spot. *Shaw Gen. Zool.* 3. p. 409. pl. 107.

COLUBER NAJA. Scutis 193, scutellis 60. *Linn. Syst. Nat. Gmel.* 1. p. 1105.

NAJA LUTESCENS. *Laur. Amph.* p. 91. no. 197.

COBRA DE CAPELLO. *Russ. Serp.* 1. pt. 1. p. 7. pl. 5 and 6.

THIS most poisonous of serpents derives its Portuguese name of cobra de capello, or hooded snake, from a custom which it has, when irritated, of expanding the skin of its neck, and bending down its head so as somewhat to resemble a hood. The effect of its poison has been well ascertained by many experiments, and found to be certainly fatal; though, from the observations of Dr. Russel, it does not seem so quick in its action as the venom of the rattle-snake. He never knew it prove mortal to a

dog in less than twenty-seven minutes, whereas the bite of the rattle-snake has been known to kill a dog in the space of two minutes.

The cobra de capello is a native of India, where it is much dreaded for the malignity of its poison. It commonly grows to the length of three or four feet; is of an uniform chestnut colour, and is remarkable for a spot on the neck which resembles a pair of spectacles. It seems that the female is without this mark, and has in consequence been mistaken for another species. The Indians who travel in the woods with naked feet are justly afraid of this snake, as it springs upon them with great agility, and its bite produces certain death, unless the proper remedies are instantly made use of. Nevertheless the Indian jugglers contrive to tame this among other serpents which they exhibit to the people. "On these occasions," says La Cepede, "the juggler holds a particular root in his hand, which he pretends has the power of insuring him against the venomous bite of his serpent. Taking the serpent from a close vessel, in which it is ordinarily kept confined, he enrages it by threatening it with a stick or his fist. The snake immediately erects itself upon its tail in a posture of defence, blows up its neck, opens its dreadful mouth with a hissing noise, thrusting out its forked tongue, and, agitating itself with great vivacity, while its eyes gleam like fire, begins a kind of combat with its master, who continues to threaten it with his fist, which he moves continually and

briskly up and down, and from side to side, singing all the while. The terrified or enraged animal, keeping its eyes constantly fixed on the hand which threatens it, follows every motion, balancing its body and head on its tail, which keeps always fixed in the same spot; and thus gives the appearance of a kind of dance. The reptile can continue this kind of exercise for about half a quarter of an hour; but whenever the juggler perceives that his serpent grows wearied, and is about to fly from the combat, he gives over his song and removes the threatening hand. The snake now ceases its seeming dance, and extends itself on the ground, when the master seizes it by the neck, and replaces it in its box or jar."

From the observations of Kæmpfer, as related by La Cepede, we are informed of the following method which these jugglers use to train up their pupils to the dance. When an Indian has procured a cobra de capello for this purpose, he turns it out of the jar in which it is kept, and prevents its escape with a stick which he uses to provoke it to fight him, holding the stick in one hand and the empty jar in the other. Whenever the snake attempts to bite it is presented with the jar, against which it hurts its nose, and is obliged to start back. This exercise is continued till the animal, always foiled in its attack, and hurt against the jar every time it attempts to bite, is obliged to give up the unequal combat, but constantly keeps its eyes fixed on the hard substance which is presented towards it, and

follows every motion. Thus, by repeated lessons, the serpent is at length trained to the task; and as it no longer attempts to bite, the juggler ventures to threaten it with his hand, and always accompanies this exercise with a kind of music; from whence it has been very improperly named a dance.

We are assured from the most respectable authority, that not only these snakes are carried about in the manner above mentioned, but also serpents of large dimensions; and the gentlemen to whom we allude, and who resided some years in India, had frequent opportunities of seeing these jugglers carry a large snake in a basket, from which he uncoiled himself at the command of his master, and was conveyed round to the spectators upon the shoulders of the men.

No kind of heathen worship has been more popular, or of higher antiquity, than that of the serpent; nor have any of the eastern nations more superstitious notions respecting it than the Gentoo Indians, who have taken this noxious reptile for the object of their religious veneration. The temples or pagodas of their gods are adorned with their images; and if the animal should enter the house of one of these people, the master first entreats it respectfully to leave his dwelling, but finding it deaf to his entreaties he offers it milk and other food; and if all will not do, he repairs to the Brahmin, who represents to the serpent the motives which ought to make him quit the house; and, among other absurdities, dwells upon the great respect and adoration

which the good man has ever shown the whole race.

We shall conclude this account with an instance of the superstitious veneration in which this creature is held on the coast of Malabar. While Dellon resided at Cananore, one of the secretaries to the reigning prince was bitten by the cobra de capello. At first he neglected to apply the usual remedies, and the people who accompanied him brought him back to the city, and carried the serpent with them in a well closed jar. The prince, being informed of the accident, sent immediately for the Brahmins, who very gravely told the serpent that the life of so faithful an officer was of the utmost importance to the state; and, being unwilling to depend alone on their prayers, they gave the snake to understand, that, if the secretary died, he most assuredly should be burnt in the same funeral pile with the body. Neither prayers, nor threatenings, nor remonstrances, seemed to make any impression on this obdurate reptile. The secretary died; but the prince, although extremely affected by the loss, having reflected that his secretary might have been guilty of some secret sins, which had drawn down the anger of the gods, ordered the serpent to be carried from the palace and restored to liberty. This was not done, however, till after abundance of apologies and reverences had been made, on the side of the prince, to appease the serpent's anger.

SNAKE.

SPECIFIC CHARACTER.

COLUBER NATRIX. C. olivaceo-fuscus (interdum cærulescens), macula collari utrinque nigra, alteraque flava, lateribus nigro-maculatis, abdomine fusco.

Olive brown, (or blueish) snake, with a black patch, accompanied by a yellow one on each side of the neck, a row of narrow black spots down each side, and dusky abdomen. *Shaw Gen. Zool.* 3. p. 446.

COLUBER NATRIX. *Linn. Syst. Nat. Gmel.* 1. p. 1100.

RINGED SNAKE. . *Penn. Brit. Zool.* 3. p. 33. no. 13. pl. 4.

THIS species is perfectly harmless, being entirely destitute of venom. It never commences an attack, and seldom attempts even to defend itself, unless when highly provoked; and then its feeble efforts are of no avail, as the bite which it is capable of inflicting can only make a trifling wound. These reptiles are very common in woods and hedges, on the dry and sunny banks of which they are frequently seen during the summer. They are likewise found among bushes in moist places, and are often seen

to take the water, as they swim perfectly well. In the viper we have noticed that the young are excluded alive: this is not the case with the common snake, which, according to La Cepede, deposits her eggs, from fourteen to twenty in number, either in holes with a warm southern aspect, or in dunghills, where they remain till the following spring before they are hatched. The eggs are connected together by a gluey matter so as to form a continued chain, and the young are rolled up spirally, in the middle of a fluid which resembles the white of a fowl's egg.

Those who have been able to conquer their prejudices against this tribe of animals have sometimes domesticated them; and we have known a gentleman who kept a common snake in his house during a winter, and constantly fed it with milk from his tea table. Mr. White, in his Natural History of Selborne, tells us of a gentleman who kept a tame snake, which was perfectly sweet in its person unless a stranger, or a dog or cat came in, when it immediately began to hiss, and filled the room with a stench that was hardly supportable. In Sardinia it appears that the country girls are very partial to these snakes, frequently keep them with great care, prepare their victuals for them, and even put it into their mouths. They are considered by the common people in that island as lucky, and therefore never driven from their doors, lest their good fortune should leave them at the same time.

As the autumn approaches, the ringed snakes seek a lodging in some hole where they can conceal themselves, at least fifteen inches below the surface of the ground; here they pass the winter in a torpid state, and become quite rigid in every part except the head and the tip of the tail. In the month of March they again revive, and from that period till towards the end of May are to be met with in abundance on warm banks and under hedges in the heat of the day. This species casts its skin in the same manner as the viper, which we have already described.

The Americans have a snake, the *coluber constrictor* Linn., which merits a share of our attention. This creature, which is black, and grows to the length of six feet, is quite as inoffensive as our own, though from its boldness and great agility it often occasions an unnecessary alarm. As every one in America is fearful of the rattle-snake, they are apt to be alarmed at the appearance of any serpent, and, without giving themselves time to consider, immediately take to their heels. This animal pursues with such swiftness as soon to overtake the fugitive, who is generally brought to the ground by the serpent coiling itself about his legs. A circumstance of this kind was mentioned to professor Kalm during his residence at New York. The gentleman who related the fact had several workmen at his country-seat, and among them one who had just arrived from Europe, and who was consequently unacquainted with the manners of the black snake.

His fellow-workmen, who knew the temper of these snakes, engaged him to kill one of two which they observed lying together, and which proved to be a male and a female; but the moment he approached to execute his purpose, the male sprung towards him. Little expecting to meet with such courage in a snake, the man flung away his stick and ran off at full speed: he was immediately pursued by his active enemy, who overtook him, and, twining several times round his legs, threw him to the ground. The man was exceedingly terrified, and could only disengage himself by cutting the snake through the body in two or three places with a knife. The other workmen, far from helping their companion, enjoyed the adventure, and looked upon it as a very good joke.

The Americans are said to encourage these reptiles on account of their great use in clearing the houses of rats, which they will pursue with amazing agility, and even chase them to the roofs of the barns and outhouses. The farmers' wives, however, have no cause to rejoice in their inmates, who very industriously skim the milk-pans of the cream, and rob the hen-roosts of the eggs. Catesby tells us they have been found coiled up in a nest under a sitting hen. They are so very active, and pass along the ground with such speed, that it is almost impossible for the person to escape when they are determined to overtake him. The only way to get rid of the creature is to face it boldly and strike it sharply with a stick.

The following scene between two snakes is described in the Letters of an American Farmer; who tells us that he was one day sitting alone in an arbour which he had raised upon his farm, when his attention was engaged by a strange sort of rustling noise at some paces distance. He looked about without being able to distinguish any thing, till he ascended to a little height above the ground, when he beheld two snakes of considerable length, the one pursuing the other with great celerity through a hemp stubble field. The aggressor was of the black kind, six feet long; the fugitive was a water snake, nearly of equal dimensions. They soon met; and, in the fury of their first encounter, appeared in an instant firmly twisted together, while they mutually tried with open jaws to lacerate each other. After this conflict had lasted about five minutes, during which time their heads were compressed to a very small size, and their eyes appeared exceedingly fiery, the second found means to disengage itself from the first, and hurried towards the ditch. Its antagonist, however, overtook it again before it reached the destined place of security, and obliged it to renew the combat. The writer described the scene which followed as uncommonly beautiful; for, thus opposed, they fought with their jaws, biting each other with the utmost rage: but, notwithstanding this appearance of mutual courage and fury, the water snake still seemed desirous of retreating towards its natural element. In this at-

tempt, it seems, he was defeated by his keen-eyed antagonist, who, twisting his tail twice round a stalk of hemp, and seizing his adversary by twisting his own neck twice round that of the water snake, pulled it back from the ditch. To prevent a defeat, the latter took hold likewise of a stalk on the bank, and, by the acquisition of that point of resistance, became a match for his black enemy. Thus mutually fastened together, and stretched at their full length, they pulled, but pulled in vain; and in the moments of greatest exertion, that part of their bodies which was entwined appeared extremely small, while the rest seemed inflated, and now and then convulsed with strong undulations rapidly following each other. "At one time," says our observer, "the conflict seemed decided: the water snake bent itself into great folds, and by that operation rendered the other more than commonly out-stretched; the next minute the new struggles of the black one gained an unexpected superiority, it acquired two great folds likewise, which necessarily extended the body of its adversary in proportion as it had contracted its own. These efforts were alternate; victory seemed doubtful, inclining sometimes to one side sometimes to the other, until at last the stalk to which the black snake was fastened suddenly gave way, and, in consequence of this accident, they both plunged into the ditch. The water did not extinguish their vindictive rage; for by their agitations I could still trace, though I could

not distinguish, their attacks. They soon re-appeared on the surface, twisted together as in their first onset; but the black snake seemed to retain its wonted superiority; for its head was exactly fixed above that of the other, which it incessantly pressed down under the water, until it was stifled, and sunk. The victor no sooner perceived its enemy incapable of further resistance, than, abandoning it to the current, it returned to the shore and disappeared."

FISHES.

The inferior rank which these creatures hold in the extensive field of Nature, makes their history less interesting than that of the quadrupeds or birds: among *them* we frequently meet with something like a reasoning faculty; but in the inhabitants of the waters we look in vain for any thing beyond the mere gratification of a voracious appetite. We would not, however, have it supposed that the wisdom of the Creator is less manifest in the formation of fishes than of other animals; but, on the contrary, most readily acknowledge, that wherever we direct our view, we perceive the traces of a Being perpetually fertile in new designs, perfectly acquainted with every circumstance of his work, and never contradicted or embarrassed by the disobedience of the materials he employs.

The first thing which occurs to our notice in the description of a fish is its scales. These are placed in an imbricated manner, and serve as a

covering to the body, and at the same time defend it from the pressure of the water. They are really curious, and afford sufficient cause for admiration when examined by the microscope. The whole surface of the animal is moistened by an oily substance, which is probably intended to defend it from extreme cold.

We should reasonably suppose, that, as the fins are the instruments of motion in fishes, those provided with the greatest number would be the quickest swimmers; but this is not always the case, as the shark, who wants the ventral or belly fins, swims with greater velocity than the haddock, which is completely fitted for motion. Assisted by these natural oars the fish cuts the water with amazing velocity, and in a moment passes the swiftest-sailing vessel. They also serve to keep the body properly balanced, particularly the belly fins, whose chief function is to regulate the motions of the body by poising it in equilibrium; so that, if the fish only moves the fins on its right side, and brings those on its left close to the body, all the motion is immediately determined that way; just as a boat with two oars, when only one of them is employed, will always turn to the side to which it is impelled by the other: deprive the fish of these fins, and the back, which is heavier than the belly, being no longer kept in a due poise, will slant on one side, or be quite inverted; and this happens to dead fish, who rise to the surface of the water with their fins uppermost. It is not to the fins alone

that the fish is indebted for its motion: the tail contributes greatly towards it; and, by its alternate impulse, advances the head and all the rest of the body, in an infinitely better manner than that by which a progressive motion is given to a boat by an oar placed at the stern, and worked about alternately to the right and left.

The uniform action of the lips and gills of a fish is doubtless analogous to our breathing: it is thus performed:—The fish first takes in a quantity of water by the mouth, which it drives backwards with a power sufficient to lift up the flap or gill cover, and force it out behind. During its passage through the feather-like process of the gills, the greater part of the air contained in the water is left behind, to perform its part in the animal œconomy. That this air is essentially necessary to support the life of the animal is sufficiently evident; for if the fish be placed in distilled water, or under the exhausted receiver of an air pump, it soon dies: therefore when a pond is frozen over it is necessary to break holes in the ice, that the fish may come to the surface and breathe. To stop the action of the gills is certain death to the animal, who presently becomes convulsed, although in its native element.

The generality of fishes are provided with a bladder or bag of air, which enables them to rise or sink in proportion to its being dilated or contracted. The body of a fish, which is heavier than the quantity of water whose place it fills, must always

descend to the bottom; and this would be the unavoidable consequence, if the fish had not in his entrails a vessel filled with air, which enables him to suspend himself in what part of the water he pleases. This vessel swells the fish a little, and enlarges his natural dimensions, without making any addition to his weight: this is a circumstance that deserves a particular consideration; for by these means he takes up more space than he could possibly fill without the vessel, and this brings him to an equilibrium with the mass of water whose place he occupies. We will suppose that the fish without this vessel weighs sixteen ounces, and that the water whose place he fills weighs no more than fifteen: the fish must in this case infallibly sink. But if we then place in the fish a little bag of air, which makes no sensible addition to the animal's weight, but only enlarges its body, this will then possess more space. If the water, then, whose place he takes up should weigh sixteen ounces, the creature is in an equilibrium with this quantity of the fluid, and will consequently be sustained in any part of the river where he may chance to find himself. But it is not sufficient for the animal merely to remain suspended; it is likewise necessary for him to rise occasionally to the top of the water, and sometimes to descend to the bottom: this he has the power of effecting by means of his abdominal muscles, with which he can compress the air-bladder, and thus diminish the bulk of his body, till his specific gravity becomes greater than that

of the water, and he consequently sinks. On the contrary, when the action of the abdominal muscles is removed, the air-bladder acquires its natural size, the body is rendered more bulky, it begins to ascend, and with the assistance of the fins is carried to the surface of the water. If this bladder bursts within the fish he can never rise again, but must be content to spend the remainder of his life at the bottom. The fishermen know this, and take advantage of the circumstance to preserve the cod alive. When they take a number of those fish, they run a needle into the sound, or air-bladder, and thus disengage the air; after which the cod lie very quietly at the bottom of their well-boats. None of the tribe of flat-fish are provided with this organ; they are, therefore, obliged to remain constantly at the bottom, unless they are provided with very large pectoral fins, which answer the purpose of wings: thus the rays, by the motion of these fins, elevate themselves in the water precisely in the same manner that birds rise in the air.

There is no doubt but fishes possess the sense of smelling, since the organ designed for that purpose is large, and capable of being contracted or dilated at pleasure. This sense is easily put to the proof; for, if a fresh worm be thrown into the water, a fish will immediately distinguish and pursue it; but if the same worm has remained there till it has lost its smell, the fish will not come near it: they may, however, be again attracted, if the worm be taken

out of the water, and an incision made on it so as to expose a new surface to the smell of the fish.

Dr. Monro describes the organ of hearing in these animals, and says it is placed on the sides of the skull, at some distance behind the eyes, and consists of a fluid and soft cretaceous substance contained in a bag: cod-fish and some others of the same shape have a hard cretaceous stone contained in each bag. Notwithstanding the Professor's description, it does not appear that they possess the faculty of hearing, but are rather affected by the vibration communicated to the water in consequence of sound. Mr. Gouan, who kept some gold and silver fishes in a vase, informs us that, whatever noise he made, he could neither disturb nor terrify them: he hollaed as loud as he could, putting a piece of paper between his mouth and the water, to prevent the vibrations from affecting the surface, and the fishes still seemed insensible; but when the paper was removed, and the sound had its full play upon the water, the fishes seemed instantly to feel the change, and shrunk to the bottom.

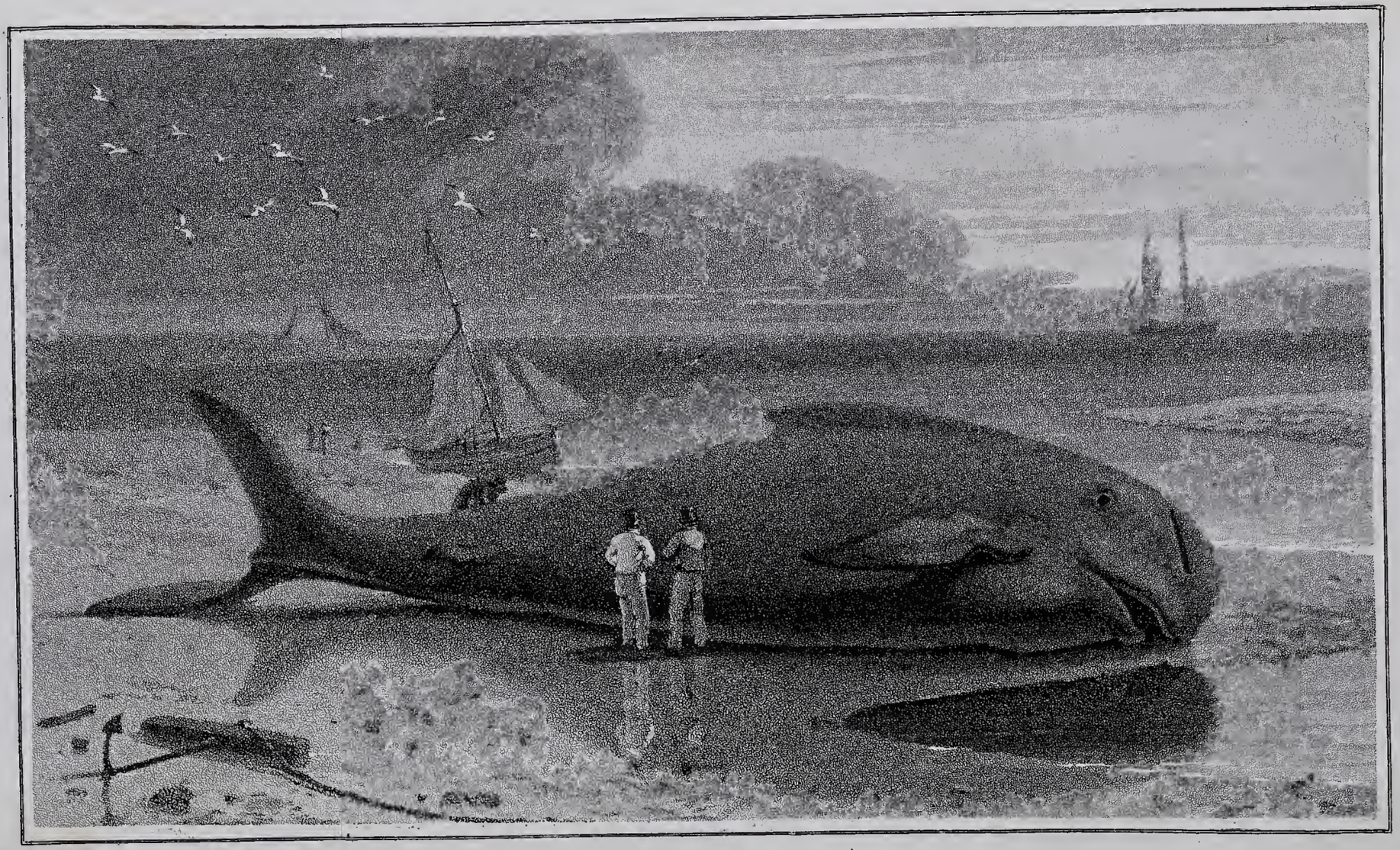
The sense of seeing is possessed by fishes in greater perfection than any other: we cannot have a stronger instance of their accurate vision than in the rostrated chætodon. This little fish actually shoots its prey. When it spies a fly sitting on the plants that grow in shallow water, it swims to within five or six feet of the place, and then with

surprising dexterity it darts from its tubular mouth a single drop of water, which never fails striking the fly into the river, where it is immediately swallowed by the fish. The crystalline lens in fishes is a complete sphere, that the rays of light coming through the medium of water may be sufficiently refracted; but as they have little if any motion in the eyes, they can never bring them both to one focus; therefore Dr. Monro thinks it probable that they may be endued with a double distinct vision.

The whole race of fishes seem to be impelled by a voracious appetite, which induces them even to destroy each other; they are constantly in action and perpetually at war. They mutually plunder and devour each other, without remorse or moderation. Those with the most capacious mouths generally commit the greatest depredations among the smaller fish, and these in their turn fall a prey to a stronger adversary. So great, indeed, is the mutual destruction of species among the inhabitants of the water, that this element in time would cease to be replenished, if Nature had not provided for the preservation of fish, by multiplying them to such an astonishing degree, that their fecundity exceeds their natural impatience to devour one another. If we only attentively consider the roe of a fish, we shall no longer wonder at the vast numbers which inhabit the water, notwithstanding all the casualties to which they are exposed. Three persons undertook to number the roe in a very fine cod: one of

them took as much of the roe as weighed a drachm, and, after having counted the eggs contained in it, passed it to the others, who did the same; and as their numbers all agreed, they wrote down the total of the whole drachm; after which, they weighed all the mass of eggs, and repeated eight times the sum of one drachm for every ounce. The addition of all these sums produced a total of nine millions three hundred and forty-four thousand eggs.

The lives of fishes are extended to a far greater length than that of other animals, and it is supposed that they are less subject to diseases. Lord Bacon tells us that the alterations in the atmosphere, which so evidently affect the constitutions of mankind, make no impression on fishes, who reside in an element little subject to change: theirs is an uniform existence; their movements are without effort, and their life without labour. Their bones also, which are united by cartilages, admit of indefinite extension; and the different sizes of animals of the same kind among fishes are very various. They still keep growing; their bodies, instead of suffering the rigidity of age, which is the cause of natural decay in land animals, still continue increasing with fresh supplies; and as the body grows, the conduits of life furnish their stores in greater abundance. How long a fish, that seems to have scarce any bounds put to its growth continues to live, is not ascertained; perhaps the life of man would not be long enough to measure that of the smallest.



WHALE.

Designed by W. Daniell.

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WHALE.

GENERIC CHARACTER.

Horny laminæ in the upper jaw, instead of teeth. *Spiracle* with a double external orifice on the top of the head.

SPECIFIC CHARACTER.

BALÆNA MYSTICETUS. B. naribus flexuosis in medio anteriore capite, dorso impenni. *Linn. Syst. Nat. Gmel.* 1. p. 223.
With flexuous spiracles on the middle of the head, and finless back.
BALÆNA GRŒNLANDICA. Fistula duplici in fronte, maxilla inferiore multa latiore. *Linn. Mus. Ad. Frid.* 1. p. 51.
WALL-FISH. *Mart. Spitzb.* p. 98. pl. 9.
COMMON WHALE. *Penn. Brit. Zool.* 3. p. 50. no. 16. *Shaw Gen. Zool.* 2. p. 478. pl. 226.

THIS species of whale, which is destitute of teeth, is supposed to feed on the different kinds of marine worms, and likewise on sea weeds. For the purpose of collecting these different sorts of nourishment, there is in the upper jaw a number of horny

laminæ split into small divisions, which is that strong and pliant substance commonly known by the name of whalebone. There are about three hundred and fifty of these laminæ on each side the jaw, five hundred of which are long enough for use, the others are too short. This immense fish is said sometimes to grow to the length of a hundred feet, though it is commonly found from forty to seventy. The eyes are remarkably small, but the head is of a prodigious size, forming nearly one-third of the animal; and when the jaws are extended the creature exposes a most enormous and terrific cavity, in which is placed a tongue eighteen or twenty feet in length, and capable of yielding five or six barrels of oil. A double pipe is situated on the head, through which the whale spouts water to a great height in the air.

These inoffensive animals are not without their enemies; for, independent of man, who, excited by avarice, ventures his life in the pursuit, they have a terrible foe to contend with in the sword-fish, which torments them without mercy. Mr. Anderson assures us, that at the sight of this little animal the whale seems agitated in an extraordinary manner, leaping from the water as if with affright; wherever it appears the whale perceives it at a distance, and flies from it in the opposite direction. "I have been myself," says Mr. Anderson, "a spectator of their terrible encounter. The whale has no instrument of defence except the tail; with that it endeavours to strike the enemy; and a single

blow taking place would effectually destroy its adversary: but the sword-fish is as active as the other is strong, and easily avoids the stroke; then bounding into the air, it falls upon its great subjacent enemy, and endeavours not to pierce with its pointed beak, but to cut with its toothed edges *. The sea all about is seen dyed with blood, proceeding from the wounds of the whale; while the enormous animal vainly endeavours to reach its invader, and strikes with its tail against the surface of the water, making a report at each blow louder than the noise of a cannon."

The tail is of an amazing size, and of a semilunar shape; the animal uses it with great effect in accelerating the motion of its enormous body, which, notwithstanding its bulk, passes through the water with great rapidity, and leaves behind it a track like that made by a large ship.

A strong instance of the affection of these creatures for each other is related by Anderson. A party of whale fishers having harpooned one of two whales, (a male and female, that were in company together,) the wounded fish made a long and terrible resistance; it struck down a boat with three men in it with a single blow of the tail, by which all went to the bottom. The other still attended its companion and lent it every assistance, till, at last, the fish that was struck sunk under the number of

* This must be a mistake, as the sword-fish always attacks its enemy with the point of its sword-shaped snout, the edges of which are not toothed.

its wounds; while its faithful associate, disdaining to survive the loss, with great bellowing, stretched itself upon the dead fish, and shared his fate.

After the female whale has gone with young nine or ten months, she produces her cub, which is of a black colour, and about ten feet long. She is said to grow fat towards the end of her pregnancy, and occasionally to bring forth two at a time, but never more. She suckles her offspring at her breast, for which purpose she inclines on one side while the young one fastens to the teat. The breasts are filled with a large quantity of milk, like those of land animals. She shows the greatest tenderness and affection for her young, and carries it with her at all times; supporting it between her fins when closely pursued, and plunging with it to the bottom in order to avoid the danger. Even when wounded she continues her attachment, and clasps her young one till she is no longer able to support it. During the time the young continue at the breast, which is about a twelvemonth, the sailors call them *short-heads*. When two years old they are termed *stunts*; and from that time forward *skull-fish*. The *short-heads* are extremely fat, and will sometimes yield above fifty barrels of blubber; but after they become *stunts* their fat diminishes, and they scarcely yield twenty-four barrels.

When the Greenlanders proceed to catch a whale they are careful to dress themselves in their best apparel, from a ridiculous notion that the whale detests a slovenly person, and would immediately

avoid them if they were not neatly clad. In this manner a number of men and women, sometimes amounting to more than fifty, set out together in one of their large boats. The women, upon these occasions, carry along with them their sewing implements, which are equally employed to mend their husbands' clothes if they should be torn, or to repair the boat if it should receive any damage in the seams. When a whale makes its appearance on the water, the most vigorous fisherman strikes into it a harpoon, which is a sort of javelin well steeled at one extremity, and five or six feet long: to this are fastened lines or straps made of seal's skin, two or three fathoms in length, and having at the end a bag of a whole seal's skin blown up. This tends in some measure to prevent the whale from sinking, and almost compels it to keep near the surface of the water, where it is constantly attacked by the people in the boat till it is killed. As soon as the animal is dead, they put on their *spring jackets*, made all in one piece of a dressed seal's skin, with their boots, gloves, and caps, which are laced so tightly to each other that no water can penetrate them. In this garb they plunge into the sea, and begin to slice off the fat all round the whale's body, even from those parts that are under water. This they can do by the help of their *spring jackets*, which, being full of air, prevent their sinking under water, and at the same time enable them to keep themselves upright in the sea. These men

are sometimes daring enough to mount on the back of a whale before he is quite dead, and begin to cut him in pieces.

The manner in which the whale fishery is carried on by the Europeans is thus described: When the ships employed in this business are arrived at the place where the whales are expected to pass, they always keep their sails set, and a sailor is placed at the mast head to give information when he sees a whale. As soon as one is discovered, the whole crew are instantly in employment; they fit out their boats, and row away to the spot where the whale was seen. The harpooner, who is to strike the fish, stands at the prow of the boat with one of these instruments in his hand, which is about six feet long, and pointed with steel like the barb of an arrow, of a triangular shape. Besides the harpooner each boat has one man at the rudder, another to manage the line, and four seamen as rowers. They are likewise provided with several lances, and six lines each a hundred and twenty fathoms long, fastened together. When the man at the prow strikes his harpoon into the animal, it immediately darts towards the bottom, and carries off the harpoon with such rapidity, that, were the line to receive the least check in its passage, the boat would infallibly be overset. To prevent this it is coiled up with the greatest care, and a man is stationed expressly to attend to the line, that it may pass without interruption. Another precaution is likewise highly

necessary: the rope is made to run over a swivel at the edge of the boat, and the friction occasioned by its swift motion is so great, that the wood would soon take fire if a person did not constantly keep it wetted. When the whale returns to the surface he is again attacked, and once more retreats in the same manner:—this is continued till he becomes faint with the loss of blood; when they venture to row close along side, and plunge a lance into his breast and through his intestines, which soon decides his fate, and the enormous animal expires. As soon as the carcase begins to float, it is towed to the ship by ropes passed through holes cut for that purpose in the fins and tail.

When the body has been properly secured to the side of the ship, they proceed to take out the blubber and whalebone, after cutting off the tail, which is hoisted upon deck. It is proper to observe, that the persons who are employed in this operation are furnished with a sort of iron spurs to prevent their slipping from off the animal. After the tail is separated, they cut out square pieces of blubber weighing two or three thousand pounds each, which are likewise hoisted on board, where they are divided into smaller pieces and thrown into the hold to drain: in this manner they proceed till all the blubber is secured, after which they suffer what remains of the carcase to float away, having previously cut out the two upper jaw-bones, which are considered as the captain's perquisite; and ac-

cordingly are fastened to the shrouds, where they discharge a considerable quantity of oil, which is caught in tubs placed under them for that purpose. When the blubber has been three or four days in the hold, they chop it into small pieces, and put it into the casks through the bung-holes.

A whale will yield from thirty to seventy butts of blubber, and will be worth from four hundred to a thousand pounds.

What induces the men to exert themselves in the capture of these animals is the premiums which their employers give, from the captain down to the men who row the boats, on every whale that is taken.

The fishery begins in May and ends in August, when they must return at all events, on account of the ice which would otherwise hem them in. When they have made a prosperous voyage, they return in June or July; and a ship of three hundred tons burthen, when full of blubber, will produce more than five thousand pounds.

It appears from Mr. Anderson's account, that the Dutch, during the space of forty-six years previous to the year 1721, had employed 5886 ships in this fishery, and caught 32907 whales; which, valued on an average at five hundred pounds each, will amount to above 16,000,000*l.* sterling.

The flesh and fat of the whale are eaten by many of the northern nations, and considered as a delicacy. However, we are not much inclined to agree

with them, but rather abide by the opinion of Frederick Martens, who, in his Voyage to Spitzbergen, says that it is as coarse and hard as the flesh of a bull. It is intermixed with many sinews, and is very dry and lean when boiled, as the fat is only to be found between the flesh and the skin. The flesh about the tail is preferred for boiling, not being quite so dry as the rest of the body. "When we have a mind to eat of a whale," says Martens, "we cut great pieces off before the tail where it is four square, and boil it like other meat; good beef I prefer far before it, yet rather than be starved I advise to eat whale's flesh; for none of our men died of it, and the Frenchmen did eat it almost daily, flinging it on the tops of their tubs, and letting it lie till it was black; and yet eating it in that condition."

Among the Kamtschatkans the fat of the whale was considered as a first-rate delicacy, and forced down the throat of the visitor with a savage officiousness that would not admit of a refusal. This beastly hospitality is now become obsolete. Formerly, as a mark of respect to a guest, the host set before him as much food as would serve ten people. Both were stripped naked:—the host refused politely to touch a bit, but compelled his friend to devour what was set before him, till he was quite gorged; and at the same time heated the place, by incessantly pouring water on hot stones, till it became insupportable. When the guest was cram-

med up to the throat, the generous landlord, on his knees, stuffed into his mouth a great slice of whale's fat, cut off what hung out, and cried, in a surly tone, *Tana*, or, There! by which he fully discharged his duty; and, between heating and cramming, obliged the poor guest to cry for mercy, and a release from the danger of being choked by the noble welcome.

EEL.

GENERIC CHARACTER.

Body long and slippery.
Nostrils tubular.
Eyes covered by the common skin.
Aperture to the gills small, and placed behind the head or pectoral fins.
Gill membrane ten-rayed.

SPECIFIC CHARACTER.

Muræna Anguilla.	M. maxilla inferiore longiore, corpore unicolore. *Linn. Syst. Nat. Gmel.* 1. p. 1133.
	Lower jaw longer than the upper; body of one colour.
	Muræna unicolor, maxilla inferiore longiore; aperturis branchialibus, pinnis pectoralibus utrinque. *Gron. Zooph.* p. 40. no. 66.
Common Eel. . .	*Bloch*, pl. 73. *Penn. Brit. Zool.* 3. p. 142. no. 63. *Shaw Gen. Zool.* 4. p. 16. pl. 1.

This well-known fish inhabits both rivers and stagnant waters, and is sometimes found in lakes and salt marshes. In the day-time it commonly re-

mains concealed in its hole beneath the banks, or buried in the mud at the bottom of the river, from whence it wanders in the night in search of prey; and has been known to quit its native element and creep along the meadows, feeding on the snails which it finds in its passage. It is very voracious, and destroys vast numbers of the fry of other fish.

Eels are viviparous, and produce their young about the end of summer. They are said to descend for this purpose into the sea; and to take the opportunity of the most obscure nights, and when the rivers are flooded by accidental rains, to seek the ocean. The young fry begin to return into the fresh water about the end of January, and continue their passage for the three following months, during which time they are taken in the river Arno by millions, but of so small a size that a vast number of them goes to the pound. The circumstance of their migration was observed by Dr. Anderson without his being able to account for it. In his publication called The Bee, we find the following passage:

"Having occasion to be once on a visit at a friend's house on Dee-side, in Aberdeenshire, I often delighted to walk by the banks of the river: I one day observed something like a black string moving along the edge of the river in shoal water. Upon closer inspection I discovered that this was a shoal of young eels, so closely joined together as to appear, on a superficial view, one continued body moving briskly up against the stream. To avoid

the retardment they experienced from the force of the current, they kept close along the water's edge the whole of the way, following all the bendings and sinuosities of the river. Where they were embayed, and in still water, the shoal dilated in breadth, so as to be sometimes near a foot broad; but when they turned a cape where the current was strong, they were forced to occupy less space, and press close to the shore, struggling very hard till they passed it.

"This shoal continued to move on night and day without interruption for several weeks. Their progress might be about a mile an hour. It was easy to catch the animals, though they were very active and nimble. They were eels perfectly formed in every respect, but not exceeding two inches in length. I conceive that the shoal did not contain on an average less than from twelve to twenty in breadth; so that the number that passed on the whole, during their progress, must have been very great. Whence they came, or whither they went, I know not. The place I remarked them at was six miles from the sea; and I am told that the same phænomenon takes place every year about the same season."

It appears that these animals are possessed of a power of climbing over any obstacle, by applying their slimy and glutinous bodies to the surface of the object they are inclined to surmount. Thus they can creep up locks, weirs, and whatever op-

poses their endeavours to pass up the stream. In the forty-fourth volume of the Philosophical Transactions Mr. Anderson informs us, that while he was viewing the flood-gates belonging to the water-works of Norwich, he observed a great number of eels sliding up them, and up the adjacent posts, to the height of five or six feet above the surface of the water. They ascended with the greatest ease, notwithstanding the posts were perfectly dry and quite smooth. They continued with their heads and about half their bodies out of the water, holding them against the wood-work for some time before they began to climb. When they found that the viscidity of their bodies was become sufficiently thick, by exposure to the air, to support their weight, they began to ascend perpendicularly, and with as much apparent ease as if they had been sliding on the level ground: this they continued till they had completed their task, and got into the dam above.

In very severe weather, the eels, who suffer from the cold, will sometimes shelter themselves in a whisp of straw thrown into a pond; and it is said that this method has been occasionally practised to catch them.

A considerable traffic is carried on in the metropolis by the sale of a variety of this fish known by the name of grigs: they are caught in the Thames, and bite readily at the baited hooks, a great many of which are generally lowered at a time, tied up in a bunch. But the great eel fisheries are, accord-

ing to Dr. Bloch, near the mouths of the Baltic, where such prodigious numbers are taken, that many waggon-loads are conveyed into Saxony, &c., after being smoked and salted for sale. In the Garonne sixty thousand are said to have been taken in one day by a single net.

ELECTRICAL GYMNOTE.

GENERIC CHARACTER.

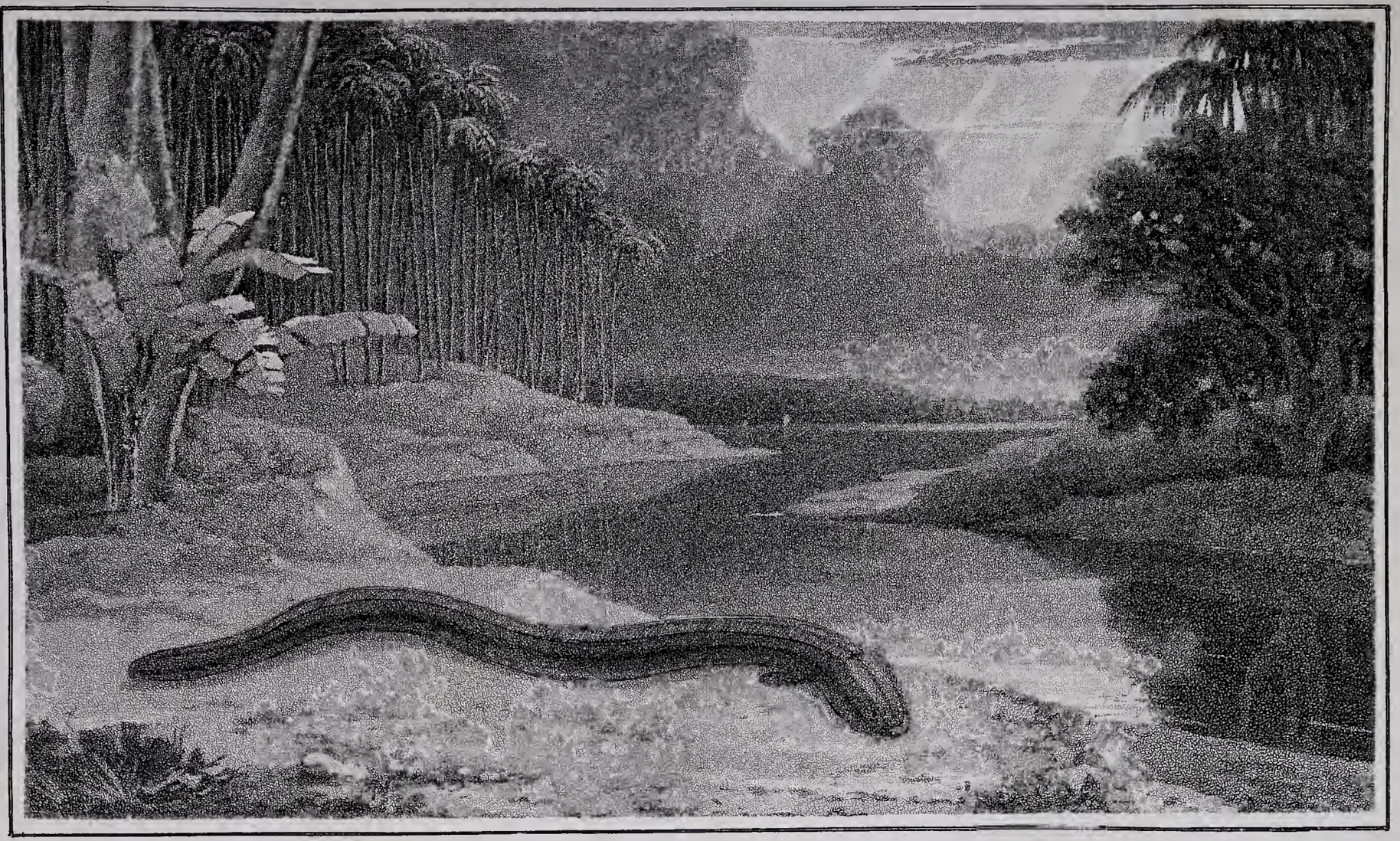
Body compressed, with a keel-shaped fin beneath.
Gill membrane five-rayed.
Two tentacula on the upper lip.

SPECIFIC CHARACTER.

GYMNOTUS ELECTRICUS. G. anguilliformis fuscus, cauda obtusa.
Anguilliform brown gymnote, with obtuse tail.
G. nudus dorso apterygio, pinna caudali obtusissima anali annexa. *Linn. Syst. Nat. Gmel.* 1. p. 1138.
Bloch Ichth. 5. p. 38. t. 156.

ELECTRICAL GYMNOTE. *Shaw Gen. Zool.* 4. p. 41. pl. 6.

THE singular property which this animal possesses in common with the torpedo, has given it a kind of celebrity, to which it would not otherwise be entitled. The rivers of South America, and particularly those of Surinam, harbour this extraordinary fish, where it sometimes grows to the length of six or eight feet. The disgusting appearance of this creature is enough to deter any one from touching it, independent of its electrical property, which im-



ELECTRIC EEL.

Designed by W. Daniell.

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mediately compels those who handle it to desist. This fish resembles an eel in figure; but it is thicker in proportion, and of a blackish brown colour. It has a flat head, and a wide mouth without teeth. A deep, soft, wavy fin rises about three or four inches below the head, and runs to the extremity of the tail. A number of bands, or rather rugæ, of the skin reach across the body, and give the fish somewhat the appearance of a worm.

The electric power of this animal is such, that a person touching it receives a shock which passes through his body in the same manner as if conveyed by a charged jar. We are told that Mr. Firmin, during his residence in Surinam, demonstrated by experiment, that fourteen slaves, holding each other by the hands, received the shock at the same instant; the first touching the fish with a stick, and the last dipping his hand into the water in which it was kept. In the second volume of the American Philosophical Transactions, Mr. Bryant observes that, one morning while he was standing by, as a servant was emptying a tub which contained one of these fish, he received a shock so violent as occasioned him to let the tub fall. Mr. B. then called another person to his assistance, and made them together lift up the tub, each laying hold only on the outside. When they were pouring off the remainder of the water, they each received a shock so smart that they were forced to desist.

A great number of experiments have been tried

by different persons on the electric power of the gymnote: as they all tend, however, to prove the same thing, we shall not dwell upon their variety, but merely give the best of them from a paper of Dr. Garden's, inserted in the Philosophical Transactions. After giving a long and very particular description of the external form of this creature, he says, " The power it has of giving an electrical shock to any person, or to any number of persons who join hands together, the extreme person on each side touching the fish, is its most singular and astonishing property. The five we have here (Charles-town, in South Carolina,) are possessed of this power in a very great degree, and communicate the shock to one person, or to any number of persons, either by the immediate touch of the fish with the hand, or by the intervention of any metalline rod. The keeper says, that when first caught, they could give a much stronger shock by a metalline conductor than they do at present. The person who is to receive the shock must take the fish with both hands, at some considerable distance asunder, so as to form the communication; otherwise he will not receive it; at least I never saw any one shocked from taking hold of it with one hand only; though some have assured me that they were shocked by laying one hand on him. I myself have taken hold of the largest with one hand often without ever receiving a shock; but I never touched it with both hands, at a little

distance asunder, without receiving a smart shock. I have often remarked, that when it is taken hold of with one hand, and the other hand is put into the water over its body, without touching it, the person received a smart shock; and I have observed the same effect follow when a number joined hands, and the person at one extremity of the circle took hold of or touched the fish, and the person at the other extremity put his hand into the water over the body of the fish. The shock was communicated through the whole circle as smartly as if both the extreme persons had touched the fish. In this it seems to differ widely from the torpedo, or else we are much misinformed of the manner in which the benumbing effect of that fish is communicated. The shock which our Surinam fish gives, seems to be wholly electrical; and all the phænomena, or properties of it, exactly resemble those of the electricity of our atmosphere when collected, as far as they are discoverable from the several trials made on this fish. The stroke is communicated by the same conductors, and intercepted by the interposition of the same original electrics, or electrics *per se*, as they are called. The keeper of these fish informed me that he caught them in Surinam river, a great way up, beyond where the salt water reaches; and that they are a fresh water fish only. He says that they are eaten, and by some people esteemed a great delicacy. They live on fish, worms, or any animal food, if it is cut

small, so that they can swallow it. When small live fishes are thrown into the water, they first give them a shock, which kills, or so stupefies them that they can swallow then easily and without any trouble. If one of these small fishes, after it is shocked, and to all appearance dead, be taken out of the vessel where the electrical fish is, and put into fresh water, it will soon revive again. If a larger fish than they can swallow be thrown into the water at a time that they are hungry, they give him some smart shocks, till he is apparently dead, and then endeavour to swallow, or suck him in; but after several attempts, finding he is too large, they quit him. Upon the most careful inspection of such fish, I could never see any mark of teeth, or the least wound or scratch upon them. When the electrical fish are hungry, they are pretty keen after their food; but they are soon satisfied, not being able to contain much at a time. An electrical fish of three feet and upwards in length cannot swallow a small fish above three or at most three inches and a half long. I am told that the electrical fish is sometimes found in the river Surinam upwards of twenty feet in length, and that the stroke or shock proves instant death to the person who receives it."

We are informed that these eels are occasionally caught in Guinea, when very young, where they preserve them for their amusement, and give them earth-worms and cock-roaches for their food. It

seems the latter are so agreeable to them, that when one is thrown into the trough where they are kept, the nearest gymnote opens his mouth, and sucks it in with great apparent pleasure. They excrete a slimy matter, which makes it necessary to change the water very often. When the trough is empty they lie motionless; but never fail when touched, even in this state, to give a violent shock.

SWORD-FISH.

GENERIC CHARACTER.

Upper jaw sword-shaped, and extended to a considerable length beyond the head.
No teeth.
Gill membrane eight-rayed.
Body smooth and slender.

SPECIFIC CHARACTER.

XIPHIAS PLATYPTERUS. . X. pinna dorsali latissima, appendicibus pectoralibus acuminatis longissimis.
Sword-fish with extremely broad back-fin, and very long sharp-pointed throracic appendages. *Nat. Miscell.* 3. pl. 88.
SCOMBER GLADIUS. S. rostro ensiformi. *Bloch* 10. p. 69. t. 345.
BROAD-FINNED SWORD-FISH. *Shaw Gen. Zool.* 4. p. 101. pl. 15.

THE sword-fish is remarkable for the great length of its upper jaw, which from its shape is commonly called the sword; and indeed it bears a considerable resemblance to that weapon, being flattish above and below, and sharp on the sides. The fish grows

to the length of twenty feet, and swims with such swiftness that its beak has been known to penetrate the stoutest plank. As a proof of this assertion we shall quote two instances. In the first, which is to be found in he forty-first volume of the Philosophical Transactions, Mr. Mortimer tells us, that his majesty's ship Leopard, when she returned from the West-Indies and the coast of Guinea, was ordered, in 1725, to be cleaned and fitted for channel service. Accordingly she was put into the great stone-dock at Portsmouth, and in stripping off her sheathing the shipwrights found the beak of a sword-fish in her bottom, which had passed through a three-inch plank, together with its sheathing, and had penetrated four inches and a half further into the solid timber. The outside of the beak is described as rough, and not unlike seal-skin, and the end where it was broken off had the appearance of ivory. The fish is supposed to have followed the ship when under sail, as the sharp end of the beak pointed towards the bow. Some idea of the force requisite to accomplish this purpose may be collected from the opinion of the workmen engaged about the vessel, who declared that it would be impossible with a hammer of a quarter of a hundred weight, to drive an iron pin of the same form and size, to the same depth in the wood, in less than eight or nine strokes.

The other account was from the captain of an East-Indiaman, who informed Sir Joseph Banks, in a letter, that the bottom of his ship was pierced through by a fish of this species, in such a manner

that the snout was completely imbedded, or driven through almost to its base, and the animal killed by the violence of its effort. The wood, together with the sword imbedded in it, is preserved in the British Museum.

The striking particulars in which this species differs from the common sword-fish, are the broad back fin, and the thoracic appendages, which are wanting in the animal that frequents our coasts.

We have already mentioned the manner in which the sword-fish attacks the whale, in our description of that creature.

COD.

GENERIC CHARACTER.

Body oblong.
Gill membrane seven-rayed.
Ventral fins slender, and ending in a point.
Teeth in the palate as well as the jaws.

SPECIFIC CHARACTER.

GADUS MORHUA. G. cauda subæquali, radio primo anali spinoso. *Linn. Syst. Nat. Gmel.* 1. p. 1162.
Tail almost even at the end; first ray of the vent fin spiny.
Gadus squamis majoribus. *Bloch*, 2. p. 145. t. 64.
COMMON COD. *Will. Ichth.* p. 165. *Penn. Brit. Zool.* 3. p. 172. no. 73. *Shaw Gen. Zool.* 4. p. 131. pl. 22.

IT appears, according to Mr. Pennant, that before the discovery of Newfoundland the principal fisheries for cod were in the seas off Iceland, and off the western coast of Scotland. To the former of these the English resorted before the year 1415; but were afterwards excluded from this fishery by treaty, and were not fairly re-established again till

the reign of James the First, when 150 vessels were employed off the coast of Iceland in the cod fishery. The famous banks of Newfoundland are now the well-known resort of our fishermen, and the number of this useful fish which is caught there is almost beyond calculation. The great bank, which lies on the southern and western side of Newfoundland, stretches from north-east to south-west, about two hundred leagues. The sea on the great bank varies in depth from twenty-two to fifty fathoms, and its situation is generally known by a thick fog on that part of the water, and a great swell.

The cod fishery is of such importance to this country, that whatever relates to it cannot fail to be acceptable to the British reader: we shall therefore make no apology for introducing the following account of the manner in which these fish are caught and cured.

"The boats or shallops (employed in this fishery) are forty feet in the keel, rigged with a main-mast and foremast, and lug sails; furnished with four oars, three of which row on one side, and the other (which is twice as large) *belays* the other three, by being rowed sideways over the stern, by a man who stands up for that purpose, with his face towards the rowers, counteracting them, and steering at the same time as he gives way to the boat.

"Each of the men in this boat is furnished with two lines, one at each side of the boat, each furnished with two hooks; so here are sixteen hooks

constantly employed; which are thought to make a tolerable good day's work of it, if they bring in from five to ten quintals of fish, though they have stowage for, and sometimes bring in, thirty. Two hundred quintals is called a saving voyage; but not under. The bait is small fish of all kinds; herring, capelin, lance, tom cod, or young cod; the first of which they salt and keep for some time, in case of scarcity of the rest; but these are not near so eagerly taken by the fish when salted. In case small fish cannot be got, they use sea fowl, which are easily taken in vast numbers, by laying nets over the holes in the rocks where they come to roost in the night. If neither small fish nor birds are to be got, they are forced to use the maws of fish they catch, which is the worst bait of any.

" When the fish are taken they are carried to the stage, which is built with one end over the water for the conveniency of throwing the offals into the sea, and for their boats being able to come close to discharge their fish. As soon as they come on the stage, a boy hands them to the header, who stands at the side of a table next the water end, whose business is to gut the fish and cut off the head, which he does by pressing the back of the head against the side of the table, which is made sharp for that purpose; when both head and guts fall through a hole in the floor into the water. He then shoves the fish to the splitter, who stands opposite to him; his business is to split the fish, be-

ginning at the head, and opening it down to the tail; at the next cut he takes out the larger part of the back bone, which falls through the floor into the water. He then shoves the fish off the table, which drops into a kind of hand-barrow, which, as soon as filled, is carried off to the salt-pile. The header also flings the liver into a separate basket, for the making of train oil, used by the curriers, which bears a higher price than whale-oil.

" In the salt-pile, the fish are spread upon one another, with a layer of salt between. Thus they remain till they have taken salt; and then are carried and the salt is washed from them by throwing them off from shore in a kind of float called a pound. As soon as this is completed, they are carried to the last operation, of drying them; which is done on standing flakes, made by a slight wattle, just strong enough to support the men who lay on the fish, supported by poles, in some places as high as twenty feet from the ground: here they are exposed with the open side to the sun; and every night, when it is bad weather, piled up five or six on a heap, with a large one, his back or skinny part uppermost, to be shelter to the rest from rain, which hardly damages them through his skin, as he rests slanting each way to shoot it off. When they are tolerably dry, which in good weather is in a week's time, they are put in round piles, of eight or ten quintals each, covering them on the top with bark. In these piles they remain three or

four days to sweat; after which they are again spread, and when dry put into larger heaps, covered with canvass, and left till they are put on board.

" Thus prepared they are sent to the Mediterranean, where they fetch a good price; but are not esteemed in England; for which place another kind of fish is prepared, called by them mud fish; which, instead of being split quite open, like their dry fish, are only opened down to the navel. They are salted, and lie in salt, which is washed out of them in the same manner with the others; but, instead of being laid out to dry, are barrelled up in a pickle of salt boiled in water.

" The train-oil is made from the livers. It is called so to distinguish it from whale or seal-oil, which they call fat oil, and is sold at a lower price, being only used for lighting of lamps, than the train-oil, which is used by the curriers :—they take a half tub, and, boring a hole through the bottom, press hard down into it a layer of spruce boughs, upon which they place the livers; and expose the whole apparatus to as sunny a place as possible. As the livers corrupt, the oil runs from them, and, straining itself clear through the spruce boughs, is caught in a vessel set under the hole in the tub's bottom."

The air-bladder, or sound, of the cod is esteemed a delicacy, and after being salted is packed in barrels and sent to England. The fishermen, both of Newfoundland and Iceland, have a method of

making isinglass from the sounds of these fish. The process is thus described:—The sound recently cut from the fish must be laid upon a block of wood, whose surface is a little elliptical, at the end of which a small hair brush is nailed, and with a saw knife the membranes on each side of the sound must be scraped off. The knife is rubbed upon the brush occasionally, to clear its teeth: after the sounds have been cut open and perfectly cleansed of the mucous matter with a coarse cloth, they are washed a few minutes in lime-water, in order to absorb their oily principle; and lastly, in clear water. They are then laid upon nets to dry in the air. The thicker the sounds are the better the isinglass; except in the colour.

February, March, and April, are considered as the three best months for this fishery, and immense numbers are taken during that time. The whole of them are caught by the hook and line; and though each fisherman takes no more than one fish at a time, an expert hand will sometimes catch four hundred in a day. In this manner is employment found for near fifteen thousand British seamen, and subsistence to a much more numerous people at home, who are engaged in the various manufactories which so vast a fishery demands.

The cod are so voracious that they will swallow almost any thing; and even stones and pebbles have been found in their stomachs. They principally feed on worms, or small fish; likewise on

crabs, whelks, &c.; and such is their power of digestion, that the shells are said to be dissolved, though so much harder than the sides of the stomach which contains them. This amazing faculty in the cold maw of fishes has justly excited the curiosity of philosophers; and we agree with Dr. Hunter, that there is a power of animal assimilation lodged in the stomach of all creatures, which we can neither describe nor define; converting the substances they swallow into a fluid fitted for their own peculiar support.

These fish are so very prolific that there is no fear of their numbers being exhausted. Leeuwenhoeck tells us that he counted nine millions three hundred and eighty-four thousand eggs in a cod-fish of a middling size; but we conclude this to be an exaggeration, since Mr. Harmer inserted in the Philosophical Transactions for the year 1767, a minute calculation of the numbers each fish may produce, and has assigned to the cod three millions six hundred and eighty-six thousand seven hundred and sixty.

We learn from Mr. Pennant, that in our seas the cod begin to spawn in January, and deposit their eggs on rough ground among rocks. Some continue in roe till the beginning of April. When they are out of season they are thin-tailed and lousy: the lice chiefly fix themselves on the inside of their mouths. In choosing cod for the table, observe that they are plump and round, especially

near the tail, and that they have a regular undulated appearance on the sides, as if they were ribbed.

The largest Mr. Pennant ever heard of, was taken on our coasts; it weighed seventy-eight pounds: the length was five feet eight inches; and the girth round the shoulders five feet. It was caught at Scarborough, in 1755, and was sold for one shilling!

SUCKING-FISH.

GENERIC CHARACTER.

A flat oval shield transversely rayed on the top of the head.
Body without scales.
Gill membrane six-rayed.

SPECIFIC CHARACTER.

ECHENEIS REMORA.	E. cauda bifurca striis capitis 18. *Linn. Syst. Nat. Gmel.* 1. p. 1187. Tail forked; about eighteen bars on the head. Echeneis pinna caudali semilunata. *Bloch,* pl. 172.
SCUKING-FISH.	*Will. Ichth.* p. 119. *App.* p. 5. t. 9. f. 2. *Catesb. Carol.* 2. pl. 26. *Shaw Gen. Zool.* 4. p. 201. pl. 31.

THESE fish are enabled, by means of their singular formation, to adhere with the utmost tenacity to other bodies. They are frequently found attached to the side of sharks, insomuch that five of them have been taken from the body of one of those animals. This extraordinary faculty did not pass un-

noticed by the antients; and accordingly we find them ascribing to the fish a power which equals enchantment. They supposed that if once the remora adhered to the bottom of a vessel its progress would be immediately stopped, notwithstanding it might be sailing with the utmost velocity. Thus Pliny was led away by this ridiculous notion, and very gravely tells us, that the ship in which the emperor Caius Caligula embarked was detained in its passage from Astura to Antium by this little fish; and, not content with giving it this extraordinary power, he likewise enables it to presage an unfortunate event, no less than the death of the emperor, whose soldiers mutinied upon his return to Rome, where he was murdered in his twenty-ninth year.

The true reason why this fish takes the advantage of other bodies to assist its motion appears evident, if we attend to the observation of Commerson, who says that the remora, from the weakness of its fins, is very badly calculated for supporting a long and laborious course in the water, insomuch that when left to itself it generally swims on its back, in a very feeble and unsteady manner. Nature has, therefore, intended that it should occasionally avail itself of the assistance of others; and for this purpose has constructed the upper part of the head in a wonderful manner. This consists of an oval shield surrounded by a narrow margin, and strengthened by a longitudinal division, from whence branch numerous transverse partitions,

each of which is fringed at the edge with perpendicular filaments. Commerson enables us to judge of its adhesive power, by what he suffered on applying his thumb to the head of a living remora; which not only affected the part with a strong stupor, but even produced a partial paralysis, that continued for some time after he withdrew his hand. We are told that this adhesive power in the remora was formerly turned to some account by the Indians of Jamaica and Cuba, who employed this animal to catch for them other fish. The remora was taken to sea fastened to a canoe by a small line many fathoms in length; and as soon as a fish came within reach, it adhered to it with such inflexible tenacity that the Indian was enabled to haul them both on shore together. In this manner, according to Oviedo, a turtle of a very large size has been taken.

The remora inhabits the Mediterranean and Atlantic seas, and grows to the length of about eighteen inches. It is of an uniform brown colour, subject to some variation.

We have on our own coasts a fish of similar adhesive powers, though of a different genus. The lump-sucker, *Cyclopterus Lumpus* Linn., has an oval aperture beneath, which is edged with small filaments, by which it is enabled to adhere to the rocks. We have a strong proof of its tenacity in the British Zoology, where Mr. Pennant assures us, that on flinging a fish of this species just

caught into a pail of water, it fixed itself so firmly to the bottom, that on taking the fish by the tail, the whole pail by that means was lifted, though it held some gallons, and that without removing the fish from its hold.

TURBOT.

GENERIC CHARACTER.

Body flat.
Eyes both on the same side of the head.
Gill rays from four to seven.

SPECIFIC CHARACTER.

PLEURONECTES MAXIMUS.	P. corpore aspero. *Linn. Syst. Nat. Gmel.* 1. p. 1236.
	Body rough.
	Pleuronectes tuberculis osseis scaber. *Bloch*, 2. p. 53. no. 8. pl. 49.
TURBOT.	*Will. Ichth.* p. 93 and 94. *Brit. Zool.* 3. p. 233. no. 109. *Shaw Gen. Zool.* 4. p. 312. pl. 45.

THIS fish, which has so long been considered as superior to every other in point of flavour, grows to a large size in the Mediterranean and Northern Seas; where, like the rest of the genus, it lies in deep water, and preys on the different marine insects and shell-fish that fall in its way. The skin of this species is of a wrinkled appearance, and covered with numerous tubercles; the largest are on the upper side. The lateral line runs over the pec-

toral fins in the form of an arch, and is continued from thence in a straight line to the tail. The eyes are on the left side.

Great quantities of these fish are taken on the northern coasts of this kingdom, as well as on those of Holland: such indeed is the extent of this fishery on the continent, that the Dutch are said to purchase annually, from the Thames fishermen, seven hundred pounds worth of small lampreys for the purpose of baiting their hooks. In England the large turbots are generally taken by the hook and line, as the method of taking them in wares, or staked nets, is not to be depended on. Mr. Pennant laments that the inhabitants of many parts of our fishing coasts, and especially those of the north parts of North Wales, should be unacquainted with the most successful means of capture. That no endeavours to inform them may be wanting on his part, this gentleman has communicated the following particulars of the method used by the fishermen at Scarborough, as they were related to him by Mr. Travis.

When they go out to fish each person is provided with three lines; each man's lines are fairly coiled upon a flat oblong piece of wicker-work; the hooks being baited, and placed very regularly in the centre of the coil. Each line is furnished with fourteen score of hooks, at the distance of six feet two inches from each other. The hooks are fastened to the lines upon sneads of twisted horse-hair, twenty-seven inches in length.

When fishing, there are always three men in each coble, and consequently nine of these lines are fastened together and used as one line, extending in length nearly three miles, and furnished with 2520 hooks. An anchor and a buoy are fixed at the first end of the line, and one more of each at the end of each man's lines; in all four anchors, which are commonly perforated stones, and four buoys made of leather or cork. The line is always laid across the current. The tides of flood and ebb continue an equal time upon our coast, and, when undisturbed by winds, run each way about six hours. They are so rapid that the fishermen can only shoot and haul their lines at the turn of the tide; and therefore the lines always remain upon the ground about six hours*. The same rapidity of tide prevents their using hand-lines; and therefore two of the people commonly wrap themselves in the sail, and sleep while the other keeps a strict look-out, for fear of being run down by ships, and to observe the weather. For storms often rise so suddenly, that it is with extreme difficulty they can sometimes escape to the shore, leaving their lines behind.

The coble is twenty feet six inches long, and five feet extreme breadth. It is about one ton burthen, rowed with three pair of oars, and admirably con-

* In this space a species of worm, the Myxine glutinosa of Linnæus, will frequently penetrate the fish that are on the hooks, and entirely devour them, leaving only the skin and bones.

structed for the purpose of encountering a mountainous sea; they hoist sail when the wind suits.

The five-men boat is forty feet long, and fifteen broad, and of twenty-five tons burthen; it is so called, though navigated by six men and a boy, because one of the men is commonly hired to cook, &c., and does not share in the profits with the other five. All our able fishermen go in these boats to the herring fishery at Yarmouth the latter end of September, and return about the middle of November. The boats are then laid up until the beginning of Lent, at which time they go off in them to the edge of the Dogger and other places, to fish for turbot, cod, ling, skates, &c. They always take two cobles on board, and when they come upon their ground anchor their boat, throw out the cobles, and fish in the same manner as those do who go from shore in a coble; with this difference only, that here each man is provided with double the quantity of lines, and, instead of waiting the return of tide in the coble, they return to the boat and bait their other lines: thus hauling one set and shooting another every turn of the tide. They commonly run into harbour twice a-week to deliver their fish. The five-men boat is decked at each end, but open in the middle, and has two large lug sails.

The best bait for all kinds of fish is fresh herring cut in pieces of a proper size; and notwithstanding what has been said to the contrary, they are taken

here at any time in the winter, and all the spring, whenever the fishermen put down their nets for that purpose:—the five-men boat always takes some nets for that end. Next to herrings are the lesser lampreys, which come all winter by land carriage from Tadcaster. The next baits in esteem are small haddocks cut in pieces, sand worms, muscles, and limpets; and lastly, when none of these can be had, they use bullock's liver. The hooks used here are much smaller than those employed at Iceland and Newfoundland. Experience has shown that the larger fish will take a living small one upon the hook sooner than any bait that can be put on; therefore they use such as the small fish can swallow. The hooks are two inches and a half long in the shank, near an inch wide between the shank and point. The line is made of small cording, and is always tanned before it is used.

Turbots and all the rays are extremely delicate in their choice of baits. If a piece of herring or haddock has been twelve hours out of the sea, and then used as bait, they will not touch it.

ROSTRATED CHÆTODON.

GENERIC CHARACTER.

Body compressed, and in most species marked with bands.
Gill membrane divided into three, five, or six rays.
Mouth set with small teeth.

SPECIFIC CHARACTER.

CHÆTODON ROSTRATUS. C. cauda integra; spinis pinnæ dorsalis 9, maculaque ocellari; rostro cylindrico. *Linn. Syst. Nat. Gmel.* 1. p. 1244.

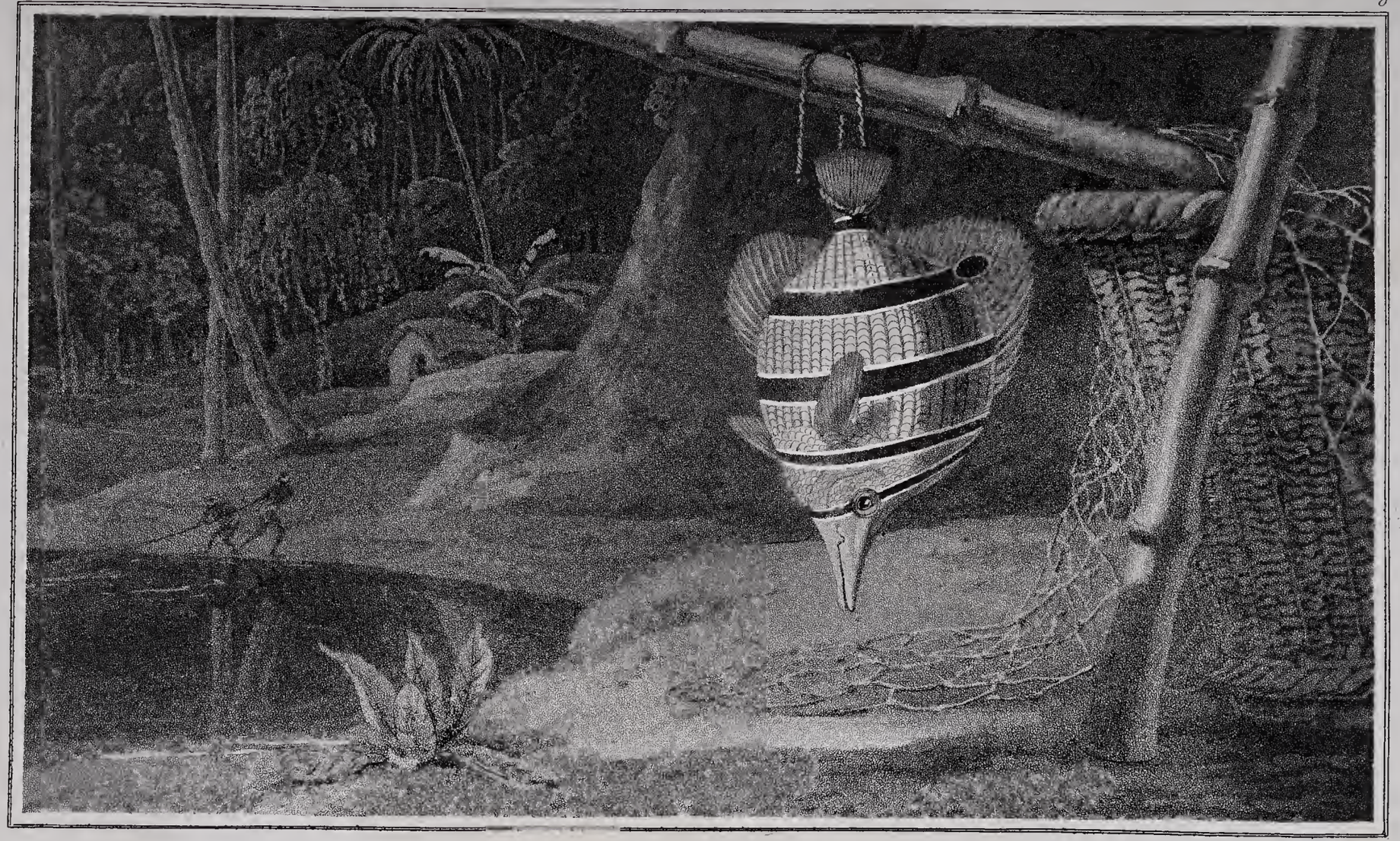
Tail undivided; a black spot bordered with white on the dorsal fin, which is armed with nine spines; beak cylindrical.

Chætodon rostro longissimo osseo, pinnis dorsi, ani, et caudæ, ad extrema rotundis; macula nigra ad pinnam dorsalem. *Gron. Zooph.* p. 69. no. 203.

CHÆTODON ENCELADUS. *Nat. Misc.* 2. pl. 67.

ROSTRATED CHÆTODON. *Bloch,* pl. 102. f. 1. *Shaw Gen. Zool.* 4. p. 337. pl. 47.

THIS expert marksman was first introduced to our notice by Mr. Hommel, governor of the hospital at Batavia, who informs us that it frequents the sides



ROSTRATED CHÆTODON.

Designed by W. Daniell.

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of rivers in India in search of food, and the manner in which it takes its prey is most singular. When it sees a fly on the plants which border the stream, it approaches in a very slow and cautious manner, till it arrives within four, five, or six feet of the object, and there rests for a moment, perfectly still, with its eyes directed towards the fly. When the fatal aim is taken, the fish shoots a single drop of water from its mouth, with such dexterity that it never fails to strike the fly into the water, where it soon becomes its prey.

When Mr. Hommel first heard of this singular fish, it so raised his curiosity, that although the account was well attested, he felt desirous to be convinced of the truth of it by ocular demonstration: he therefore ordered a capacious tub to be filled with water, and some of these fish put into it: When they had been there a sufficient time to become reconciled to their confinement, he determined to try the experiment; and accordingly pinned a fly to the end of a slender stick, which was placed in such a direction by the side of the vessel that the fish could easily strike it. Every thing succeeded to his wish; and he assures us that he daily saw these fish exercising their skill in shooting at the fly, and that with a dexterity which never failed to hit the mark.

The fish never exposes any part of its mouth out of the water, though it frequently shoots a great many drops one after another without leaving its

place. This species is called by Mr. Hommel, the jaculator.

The length of the fish is about six or eight inches; the body is marked with five transverse brown bands with white edges; the first band, which is not so broad as the others, passes across the head and through the eyes; the last across the base of the tail.

The remarkable faculty which the rostrated chætodon possesses is said to be found in some few others of very different genera.

CLIMBING SPARUS.

GENERIC CHARACTER.

Jaws bony, divided in the middle and indented on the edge.

SPECIFIC CHARACTER.

SPARUS SCANDENS. S. olivaceus, subtus flavescens, oculis aureis. Olive-green, with yellowish abdomen, and gold-coloured eyes.

PERCA SCANDENS. *Linn. Trans.* 3. p. 62.

CLIMBING SPARUS. *Shaw Gen. Zool.* 4. p. 475.

THE learned Dr. Shaw has given the following translation of lieutenant Daldorff's paper respecting this singular fish, from the Linnean Transactions:

"Length about a span; skin covered with a blackish mucus; dorsal fin occasionally sunk in a longitudinal fossule; it has seventeen spiny and eight soft rays; the pectoral fins have twelve rays, the ventral six, the tail eighteen, of which ten are spiny, the rest soft.

"This fish is remarkable for its power of climbing, which it performs by the assistance of the spines of its gill-covers, moving itself at pleasure up the stems of trees growing near the waters it fre-

quents. In this situation it was observed in the month of November 1791, at Tranquebar, by lieutenant Daldorff, who communicated its description to sir Joseph Banks. It was seen ascending a fissure in the stem of the palm called *Borassus flabellifer*, growing near a pool of water, and was observed to move itself forwards by alternately applying the spiny sides of the gill-covers to the sides of the fissure, assisting itself at the same time by the spines on each side the tail, and had already ascended to the height of more than five feet above the water when it was first observed; it was found to be very tenacious of life, moving about on dry sand many hours after it was taken. The spines of the gill-covers are considered by the natives as of a poisonous nature."

MACKREL.

GENERIC CHARACTER.

Body oblong and smooth.
Gill membrane seven-rayed.
Several small fins towards the tail.

SPECIFIC CHARACTER.

SCOMBER SCOMBER. S. cæruleus, lineis numerosis transversis nigris, abdomine argenteo, pinnulis supra infraque quinque.

Blue mackrel, with numerous transverse black lines, silvery abdomen, and five finlets above and below. *Shaw Gen. Zool.* 4. p. 577. pl. 84.

SCOMBER. Pinnulis quinque. *Linn. Syst. Nat. Gmel.* 1. p. 1328. *Bloch*, 2. p. 88. no. 1. pl. 54.

COMMON MACKREL. *Will. Ichth.* p. 181. *Penn. Brit. Zool.* 3. p. 264. no. 132. pl. 51.

AMONG the numerous inhabitants of the ocean, there is not one that exceeds the mackrel in the brilliancy of its colours, or the elegance of its shape. The fine deep blue upon the back, crossed by many black streaks, and accompanied by a tinge

of green which varies as the fish changes its position: the bright silver colour of the abdomen, and the varying tinge of gold green which runs along the sides, are eminently beautiful in this species; but are only to be seen in perfection when the fish is first taken from the water, as death considerably impairs the colours, though they are then far from being obliterated.

Immense swarms of mackrel visit our coasts at particular seasons of the year; and, after remaining a few months, leave us, as we are informed, to winter within the arctic circle; where they lie, during the severity of the weather, imbedded in the soft mud, and are thus protected from the effects of frost. They are sometimes even partly enclosed by the ice, which has been seen entirely bristled over by the tails of mackrel, imbedded in it nearly three parts of their length. They were observed in this situation by M. Pleville-le-Peley, about the coasts of Hudson's Bay, where they were found in the mud at the bottom of the small hollows, completely incrusted with ice. In this torpid state they are said to remain till they are enlivened by the return of spring, and again induced to make their annual visits. It has been observed that their eyes are very dim when first they leave their re treats, and appear to be covered with a white film, which disappears about the beginning of summer, and leaves the fish in full perfection.

The mackrel are supposed to pursue nearly the same route as the herrings, in their annual mi-

grations, passing between Iceland and Norway, and then bending their course towards the northern part of Great Britain, where they separate; one shoal going towards the Baltic, while the other, which is by far the largest, passes downwards, and enters the Mediterranean through the straits of Gibraltar. Dr. Shaw, however, seems to doubt these periodical journeys, and says, that it is thought more probable that the shoals which appear in such abundance round the more temperate European coasts, in reality reside during the winter at no very great distance; immersing themselves in the soft bottom, and remaining in a state of torpidity; from which they are awakened by the warmth of the returning spring, and gradually recover their former activity.

The mackrel, of all other fish, was most preferred by the Romans in the preparation of a sauce in much esteem amongst them. The *garum* gave a high relish to their food, and vast quantities of it were extracted from the mackrel taken near Carthagena, at which place it bore a high price, being prepared by a certain company, and thence distinguished by the title of *garum sociorum*.

On the western coast of England a very extensive fishery is carried on for mackrel. They are caught in nets at a great distance from the shore, and the cargo of a single boat is sometimes very valuable, having been known to sell for upwards of sixty pounds. The nets are lowered during the

night, and stretch, across the tide, to the extent of several miles; and the meshes are made just large enough to admit the heads of the large-sized fish, and catch them by the gills. Mr. Bingley relates the following method of fishing for mackrel with a ground seine, as it was communicated to him by J. Stackhouse, esq.:—"A roll of rope of about two hundred fathoms in length, with the net fastened to the end, is tied at the other to a post, or rock, on the shore. The boat is then rowed to the extremity of this coil, when a pole fixed there, loaded heavily at the bottom, is thrown overboard. The rowers from hence make as nearly as possible a semicircle, two men continually and regularly putting the net into the water. When they come to the other end of the net, where there is another leaded pole, they throw that overboard. Another coil of rope, similar to the first, is by degrees thrown into the water, as the boatmen make for the shore. The boat's crew now land, and, with the assistance of persons stationed there, haul in each end of the net till they come to the two poles. The boat is then again pushed off towards the centre of the net, in order to prevent the more vigorous fish from leaping over the corks. By these means three or four hundred fish are often caught at one haul."

These fish are said to be exceedingly voracious; a circumstance not forgotten by Bishop Pontoppidan; who, among other things equally extraor-

dinary, tells us of a sailor who was attacked by them, while bathing in one of the harbours on the coast of Norway, and, notwithstanding a boat's crew went immediately to his assistance, was too far gone to be recovered. Mackrel will readily take a bait, particularly when the wind blows fresh.

SALMON.

GENERIC CHARACTER.

Body compressed, and furnished towards the tail with a fat fin.
Tongue cartilaginous.
Teeth both in the jaws and on the tongue.

SPECIFIC CHARACTER.

SALMO SALAR. S. rostro ultra inferiorem maxillam prominente. *Linn. Syst. Nat. Gmel.* 1. 1364.
Beak projecting beyond the lower jaw.
S. griseo-argenteus, corpore maculato, maxillis maris apice incurvatis. *Shaw Gen. Zool.* 5. p. 39. pl. 102.

SALMON. . . *Will. Ichth.* p. 189. pl. 11. f. 2. *Bloch,* pl. 20. and 98. *Penn. Brit. Zool.* 3. p. 284. no. 143. pl. 58.

IT would be needless to detail the form of so well known a fish as the salmon; we shall, therefore, proceed to relate what is interesting in its natural history, after having noticed that the male is principally distinguished from the female by the curvature of the jaws; both the upper and lower man-

dible bending towards each other more or less in different individuals, and at different seasons.

Salmon inhabit both the fresh and salt water; they are unknown in warm climates, never stretching even so far as the Mediterranean sea. The most remarkable part of their history is the account we have of their persevering industry in surmounting every obstacle to reach the place where they deposit their spawn. We are assured that to accomplish this purpose they will ascend rivers for hundreds of miles; force themselves against the most rapid streams, and spring with amazing agility over cataracts of several feet in height. At Pont Aberglaslyn Mr. Pennant observed the efforts of scores of these fish, who attempted to pass a perpendicular fall in the river. This gave him an opportunity to contradict the vulgar error of their taking their tail in their mouth when they attempt to leap, as he noticed that they all sprang up quite straight, and with a strong tremulous motion. They often miscarry several times before they surmount the difficulty, and this occasions many of them to be captured; for at the falls of Kilmorach in Scotland, where the salmon are very numerous, the peasants are in the habit of laying branches of trees on the edges of the rocks, by which means they often take such fish as miss their leap. At other places it is a common practice to fix baskets made of twigs near the edge of the stream to catch them in their fall. The natives of Kamtschatka almost depend for their subsistence on the salmon, which visit

their rivers in great abundance. All the different kinds are said to be found there, and it has been noticed that each shoal keeps apart from others of different species, and frequently prefers a separate river, notwithstanding the mouths may be almost contiguous. They swim in such numbers as to force the water before them, and even to dam up the rivers, and make them overflow their banks; insomuch that on the fall of the water great multitudes are left on the dry ground, and would probably cause a pestilence by rotting there, if they were not fortunately dispersed by the violence of the winds, assisted by the bears and dogs who prey on them, and thus lessen the ill effects. Salmon are said to remember the spot where they have once spawned, and to return to it again. M. de la Lande, who fastened a small ring of copper to the tails of some of them, and then set them at liberty, was assured by the fishermen that they returned to the same place for three succeeding seasons.

The best account we have of the salmon fishery has been collected by Mr. Pennant, who received some interesting communications from Mr. Potts of Berwick. To these observations we chiefly stand indebted for what follows.

At the latter end of the year, or in the month of November, the salmon begin to press up the rivers as far as they can reach in order to spawn; when that time approaches, they search for a place fit for their purpose, where the male and female unite in forming a proper receptacle for their ova in the

sand or gravel: the hole in which the spawn is deposited is about eighteen inches deep; this they carefully cover, it is supposed, with their tails; for after spawning they are observed to have lost the skin on that part. As soon as this operation is completed, the parents hasten to the sea to recruit their strength; for after spawning they become very poor and lean, and then are called kipper. When the fish first enter the rivers they are observed to be infested with the salmon-louse, *lernæa salmonea* Linn.: these insects adhere in abundance above the gills, and are signs that the fish are in high season. Soon after the salmon have left the sea, the insects die and drop off.

The spawn, which lies buried all the winter, begins about the latter end of March to exclude the young, which gradually increase in size to the length of four or five inches, and are then called salmon smelts: about the beginning of May the river is full of them; they swarm in such myriads that the water seems all alive; but the first flood sweeps them all into the sea, scarcely leaving one behind. About the middle of June the largest of these return again into the river, and are at that time between twelve and sixteen inches long; after this they increase in size and number till about the end of July, which is at Berwick termed the height of *gilse* time, a name given to the fish at that age: the beginning of August they lessen in number, but increase very much in size, some of them

being nine pounds in weight. Their growth indeed is remarkably quick, as the following instance will sufficiently prove. A gentleman at Warrington took a kipper salmon weighing seven pounds and three quarters on the seventh of February; after having marked the fish on the back, fin, and tail, with scissars, he turned it into the river; on the seventeenth of March following the same salmon was again taken, and then weighed seventeen pounds and a half.

All fishermen agree that they never find any food in the stomach of these fish; this is singular, as it is evident that at times they feed both on fish and worms; for the angler uses both with good success, as well as a large gaudy artificial fly.

About the month of July a prodigious number of salmon are caught in the Tweed:—in a good fishery, often a boat load, and sometimes near two, are taken in a tide; it is very common to take from fifty to a hundred at a haul; and it is even said that some years ago above seven hundred were taken at once in this manner. At this season many are salted, and afterwards packed in barrels for exportation, having then far more than the London markets can possibly take off their hands. Most of the salmon taken in the spring is sent to London in baskets, unless the vessel is prevented by contrary winds from sailing immediately; in that case the fish is brought ashore again to the coopers' offices, and after being boiled, pickled, and kitted,

is sent to the London markets by the same ship, and the baskets again filled with fresh salmon, in the room of the stale ones.

The season for fishing in the Tweed begins about the thirtieth of November, and ends on Michaelmas-day. There are on the river above forty considerable fisheries, extending upwards about fourteen miles from the mouth. These were rented several years ago at upwards of ten thousand pounds; consequently the annual produce to defray the expenses could not have been less than twenty times that sum of fish; so that above two hundred thousand salmon must have been caught there one year with another.

Scotland is rich in fine fisheries, and several laws were enacted in early times to preserve the fish; for in the reign of James the Fourth, the third offence was made capital. Before that time the offender had power to redeem his life. A considerable fishery is likewise carried on at Cranna in Ireland; the place is situated on the river Ban, about a mile and a half from Coleraine. In this river they fish with nets eighteen score yards long, and are continually drawing night and day the whole season, which lasts about four months, two sets, of sixteen men each, alternately relieving one another. The best drawing is when the tide flows, at which time it is said that eight hundred and forty fish were once taken at a single draught.

In several countries salmon form a great article of commerce, and are cured either by salting,

pickling, or drying. The Kamtschatkans keep them for home consumption: they make a dish called *joukola* of the salmon cut into six pieces, and dried either in the open air, or smoked; the roes are likewise greatly esteemed by them, either dried in the air or before the fire. They can live a long time on a small quantity of this roe, and eat with it the bark of birch or willow trees, to assist them in swallowing a food so very viscid; but their ambrosial repast, says the author of the Arctic Zoology, is the fish flung into a pit till it is quite rotten; when it is served up in the state of carrion, and with a stench unsupportable to every nose but that of a Kamtschatkan.

PIKE.

GENERIC CHARACTER.

Upper jaw shorter than the lower.
Teeth in the jaws, the palate, and the tongue.
Body oblong, slender, and compressed.

SPECIFIC CHARACTER.

ESOX LUCIUS. E. rostro depresso subæquali. *Linn. Syst. Nat. Gmel.* 1. p. 1390.
Depressed subequal jaws.
ESOX LUCIUS. Capite compresso, rictu amplo. *Bloch*, pl. 32.
Esox rostro plagioplateo. *Art. Synon.* 26.
PIKE. . . *Penn. Brit. Zool.* 3. p. 320. no. 153. pl. 63. *Will. Ichth.* p. 236. *Shaw Gen. Zool.* 5. p. 100. pl. 108.

WHEN first these fish were introduced into England in the reign of Henry the Eighth, they were so rare that a pike was sold for double the price of a house lamb in February, and a pickerel for more than a fat capon. How far this may be depended on Mr. Pennant cannot say, for the fish is mentioned in the *Boke* of *St. Albons*, printed in the year 1496, and is not there spoken of as a scarce fish, as was

then the case with respect to the carp. As early as the year 1466, great numbers of this fish were served up at the splendid feast given by George Nevil, archbishop of York.

Boulker mentions a pike that was an ell long and weighed thirty-five pounds. He tells us that it was caught by his father, and presented to Lord Cholmondeley. This pike, it seems, devoured all the fish in the canal where it was placed, so that, when the water was suffered to run off, only one solitary carp remained, and even that carried about with it the marks of its ferocious enemy, having been bitten in several places. The canal was again stocked with fish, which in the course of a twelvemonth all met with the same fate as their predecessors. His insatiable voracity even induced him to pull the ducks under water, and he was frequently seen at this practice by the workmen who were engaged near the canal. After this he was fed with the garbage from a slaughter-house; but at length his keepers became careless, and he died; it is supposed in consequence of their neglecting to supply him with his proper food.

The intelligent Mr. Pennant has given the best general history of this fish, and to him we principally stand indebted for what follows.

The jaws of the pike are very loosely connected, and have on each side an additional bone like the jaw of a viper, which renders them capable of greater distension when the fish swallows its prey. It does not

confine its appetite to frogs and fishes, but will devour the water-rat, and sometimes most unnaturally prey upon its own species; Mr. Pennant having seen one that was choked by attempting to swallow another that proved too large a morsel. The following singular fact rests upon good authority. At Lord Gower's canal at Trentham a pike seized the head of a swan as she was feeding under water, and gorged so much of it as killed them both. A similar instance happened at the seat of Sir James Lowther some years ago, where a swan was perceived in the same situation, with her head under water, by some men who passed the canal in the morning, and returned by the same at night. The swan was drawn out with a large pike attached to her neck, great part of which it had contrived to swallow.

The great voracity of this fish has been exagerated by Gesner, who tells us, that a famished pike in the Rhone seized on the lips of a mule that was brought to water, and that the beast drew the fish out before it could disengage itself: that people have been bitten by these voracious creatures while they were washing their legs; and that they will even contend together for their prey, and endeavour to force it out of each others mouth.

The smaller fish are very uneasy in the presence of this tyrant, and are observed, when the pike lies dormant near the surface, to swim round him in vast numbers, and in great anxiety. They often

lie thus asleep in the ditches near the Thames, in the month of May, and are at that time frequently haltered in a noose. In the shallow water of the Lincolnshire fens, they have a manner of catching them which we believe is peculiar to that county and the isle of Ceylon. The fishermen make use of what is called a crown net, which is no more than a hemispherical basket, open at top and bottom. The man stands at the end of one of the little fen-boats, and frequently puts his basket down to the bottom of the water, then poking a stick into it, discovers whether he has any booty by the striking of the fish: vast numbers of pike are taken in this manner.

The longevity of this fish is very remarkable, if we may credit the accounts given of it. Rzaczynski tells us of one that was ninety years old: but Gesner goes far beyond him, and relates, that in the year 1497 a pike was taken near Hailbrun, in Swabia, with a brazen ring affixed to it, on which were these words in Greek characters: "I am the fish which was first of all put into this lake by the governor of the universe, Frederick the Second, the fifth of October 1230." Mr. Pennant very properly observes, that the former must have been an infant to this Methusalem of a fish.

Pikes spawn in March or April, according to the coldness or warmth of the weather. They are common in most of the lakes of Europe; but the largest are those taken in Lapland, which, if we may credit

Schæffer, are sometimes eight feet long. When they are in high season their colours are very fine, being green spotted with bright yellow, and the gills of a most vivid and full red. When out of season the green changes to gray, and the yellow spots turn pale.

FLYING-FISH.

GENERIC CHARACTER.

Head covered with scales.
Gill membrane ten-rayed.
Pectoral fins very long.

SPECIFIC CHARACTER.

EXOCŒTUS VOLITANS. E. abdomine utrinque carinato. *Linn. Syst. Nat. Gmel.* 1. p. 1399.
The abdomen carinated on both sides.
EXOCŒTUS EVOLANS. E. argenteus, dorso subfusco, pinnis ventralibus ante medium abdominis. *Shaw Gen. Zool.* 5. p. 144. pl. 117.
Exocœtus pinnis ventralibus parvis prope pectus. *Bloch*, pl. 398.

FLYING FISH. . . . *Penn. Brit. Zool.* 3. p. 333. no. 159. pl. 67. *Will. Ichth.* 233.

THE remarkable singularity which distinguishes these fish from all others, is their ability to sustain themselves in the air during a temporary flight of a few hundred feet. The idea of a fish having the power to leave its own element and occasionally

assume the property of a bird, appears very unnatural. But this seeming contradiction in the dispensation of Providence will completely vanish, when we consider that this extraordinary action is merely an apology for flying, and can only be supported while the pectoral fins are wet. These fins are extremely long, and capable of considerable motion backwards and forward. They are composed of ribs connected together by a transparent membrane, and by the assistance of these they are enabled to spring into the air; but the moment the moisture is evaporated from their surface, the fish are again obliged to return to their own element. The large air-bladder with which this fish is provided, greatly contributes to diminish its specific gravity, and consequently tends to support it in its aërial excursions. From the observations of Captain Tobin, who carefully watched the motions of the flying-fish about Otaheitee, it appears that the lower half of the tail, which is by far the longest, is of great use to them in their flight. This gentleman frequently saw the dolphins and bonitos in pursuit of them, when they had disposed the lower part of their tail in such a manner as to supply their wings with moisture, and thus support them above the surface. He never saw one exceed the distance of a hundred yards in its flight, without being obliged to dip for a fresh supply. The persecution which this species suffers from the fish of prey, induced Mr. Pennant to suppose that they lead a most miserable life.

We cannot, however, believe with him, that this is strictly the case; since the great Author of nature has weighed the happiness of his creatures in a balance so nicely regulated, that neither of the scales appears to preponderate.

The shape, excepting the head, is not unlike that of a herring: it has large and silvery scales, and the length of the animal is from twelve to fifteen inches. The pectoral fins, as we have already noticed, are very long; the tail is forked.

POLYNEME.

GENERIC CHARACTER.

Head compressed, having a very obtuse prominent snout, and a number of slender filaments under the jaw.
Gill membrane with an unequal number of rays.

SPECIFIC CHARACTER.

POLYNEMUS NILOTICUS. P. argenteus, digitis utrinque quinque mediocribus, naso subrubente.
Silvery, with five moderately long thoracic filaments on each side, and reddish snout.

SILVERY POLYNEME. . *Shaw Gen. Zool.* 5. p. 151. BINNY. *Bruce's Travels,* 8vo ed. v. 7. p. 305.

Mr. BRUCE met with this fish at Achmim, the antient Panopolis. He extols its flavour, and says that it equals any of the fish inhabiting the rivers running either into the Mediterranean or the ocean. The specimen which Mr. Bruce has figured, he informs us, weighed thirty-two pounds; but he was assured by the fishermen that they are often taken

of seventy pounds and upwards. The largest of this kind are caught about Rosetta; but they are found in greater numbers higher up the Nile, and particularly near the first cataract, and at Syene. The inhabitants have a very singular way of catching these fish, which it seems is attended with great success. They prepare a quantity of oil, clay, flour, and honey, with straw, or any other material that will bind the whole together, and tread it with their feet till it be perfectly mixed. They then take two handfuls of dates, and break them into small pieces about the size of the point of the finger, and stick them in different parts of this mixture, which now adheres perfectly together, and in form is not unlike a Cheshire cheese. In the heart of this cake thy put seven or eight hooks, with dates upon them, and a string of strong whipcord to each. Thus prepared, the fisherman commits himself to the river upon a blown goat's skin, carrying the cake before him, till he arrives at the middle of the stream; there he drops the mass in the deepest part of the water, and cautiously holding the ends of each of the strings slack, so as not to pull the dates and the hooks out of the heart of the composition, he makes for the shore again a little below the place where he had sunk the bait. He then carefully separates the ends of the strings, ties each of them to a palm branch, made fast on shore, and at the end of every branch hangs a small bell. The business being so far settled, he either goes to feed his cattle, dig trenches,

or perhaps to sleep. During this time the cake begins to dissolve, pieces fall off, the broken dates dipped in honey flow down the stream, and the large fish below catch eagerly at them as they pass. Thus tempted, they rush up the stream, collecting the pieces as they go, till they arrive at the principal mass; where they immediately seek the dates buried in the composition, and, without suspecting the snare, greedily swallow them together with the hooks. As soon as a fish feels himself fast, he makes off as speedily as possible, and in attempting to escape from the line by which he is fastened, pulls the palm branch and consequently rings the bell. As soon as the fisherman hears this welcome sound he runs to the water, and, having drawn his prisoner on shore, passes an iron ring through his jaw; he then fastens a few yards of cord to it, which he makes fast to the bank, and again commits the fish to the water. This precaution is necessary, as dead fish will not keep in Egypt. The inhabitants of Girge, a large town opposite the place where they are taken, come to the spot as to a fish market, and every man takes the quantity he wants, buying them alive. Mr. Bruce bought two, which, he informs us, fully dined his whole boat's crew. It is rare to find even one hook empty; the fisherman had then ten or twelve fastened to the shore, which he took out of the water on purpose to show them.

The fish is thus described by Dr. Shaw: The whole body is covered with scales of a brilliant silver colour,

so as to resemble spangles lying close together; and there is no variety of tinge on the fish, except a shade of red on the end of the nose, which is fat and fleshy; the eye is large and black, with a broad yellowish-white iris; the teeth are small, very sharp, and close-set; the first dorsal fin has eight spiny rays, the first of which is very short; the second dorsal fin has eleven soft or branched rays; the pectoral and ventral fins are also furnished with rays of a similar kind; the setaceous processes are five in number on each side, gradually lengthening as they recede from the mouth, the last appearing nearly to equal half the length of the body; the tail is deeply and sharply forked, the upper lobe extending somewhat beyond the lower.

HERRING.

GENERIC CHARACTER.

Eight gill rays.
Belly very sharp, and generally serrated.

SPECIFIC CHARACTER.

CLUPEA HARENGUS.	C. immaculata, maxilla inferiore longiore. *Linn. Syst. Nat. Gmel.* 1. p. 1402. Without spots; lower jaw longer than the upper. Clupea maxilla inferiore longiore, pinna ani radiis septendecim. *Bloch,* pl. 29. f. 1.
HERRING. . . .	*Will. Ichth.* p. 219. *Penn. Brit. Zool.* 3. p. 335. no. 160. pl. 68. *Shaw Gen Zool.* 5. p. 158. pl. 119.

HERRINGS are fish of passage, and are found in the greatest abundance in high northern latitudes. They seem to have their capital between the points of Scotland, Norway, and Denmark, from whence the Danish colonies take their progress every year; and after having traversed the channel, and passed by Holland and Flanders, visit our coasts. They are

not a troop of stragglers who rove about at random, but a regular army, whose tour is prescribed, and whose march is yearly regulated with the utmost exactness. The whole body begin their departure at the same time; none are permitted to straggle out of their proper track; none among them desert; but all continue their progress from coast to coast, till the appointed period. They are exceedingly numerous, and the voyage is long; and when the body of the army is passed, they are all gone, and return no more till the next year. It is supposed that the herrings make their annual migrations in pursuit of food. Our fishermen, as well as those of Holland, have observed, that the channel every year teems with an innumerable multitude of worms and little insects, on which the herrings feed. They are a kind of manna, which these creatures come punctually to gather up; and when they have entirely cleared the seas in the northern parts of Europe, during summer and autumn, they descend towards the south, where they are invited by a new stock of provisions.

Multitudes of these creatures take up their winter quarters within the arctic circle. In those inaccessible seas, that are covered with ice for a great part of the year, they find a quiet and sure retreat from all their numerous enemies, and abundance of insect food for their subsistence. Anderson even supposes that they would never depart from hence if their numbers did not make it necessary for them to mi-

grate, and, like bees from a hive, form other colonies. They no sooner leave their retreats, but millions of enemies appear to thin their squadrons. Whales swallow hundreds at a yawn; the porpoise, the grampus, and the different species of shark, find them an easy prey, and spread extensive ruin among them. They are likewise tormented by the sea-fowl, who watch their motions and attend them on their voyage. Thus assailed on every side, they seek for safety by crowding closer together, and leaving the outer ones to be first devoured. The large body which moves to the west passes along the coast of America as far south as Carolina, but seldom much farther. They arrive at Georgia and Carolina about the latter end of January, and in Virginia in February; from hence they coast eastward to New England. They then separate, and run up every river and stream they can find, in order to deposit their spawn, where they continue till the latter end of April, when the old fish return to the sea, and steer to the northward till they reach Newfoundland.

Mr. Pennant thus describes the visit which the herrings annually pay our shores, after having informed us that the word herring is derived from the German *heer*, an army, to express their numbers:

"They begin to appear off the Shetland isles in April and May: these are only forerunners of the grand shoal, which comes in June, and their appearance is marked by certain signs; by the numbers of birds, such as gannets and others, which

follow to prey on them; but when the main body approaches, its breadth and depth is such as to alter the very appearance of the ocean. It is divided into distinct columns of five or six miles in length, and three or four in breadth; and they drive the water before them with a kind of rippling; sometimes they sink for the space of ten or fifteen minutes, then rise again to the surface; and in bright weather reflect a variety of splendid colours, like a field of the most precious gems, in which, or rather in a much more valuable light, should this stupendous gift of Providence be considered by the inhabitants of the British isles.

"The first check this army meets in its march southward, is from the Shetland isles, which divide it into two parts; one wing takes to the east, the other to the western shores of Great Britain, and fill every bay and creek with their numbers; others pass on towards Yarmouth, the great and antient mart of herrings; they then pass through the British Channel, and after that, in a manner, disappear: those which take to the west, after offering themselves to the Hebrides, where the great stationary fishery is, proceed towards the north of Ireland, where they meet with a second interruption, and are obliged to make a second division; the one takes to the western side, and is scarce perceived, having been lost in the immensity of the Atlantic; but the other, which passes into the Irish sea, rejoices and feeds the inhabitants of the coasts that border it.

"These brigades, as we may call them, which are thus separated from the greater columns, are often capricious in their movements, and do not show an invariable attachment to their haunts."

The herrings in our seas are said to feed on a crustaceous insect, the *oniscus marinus* Linn., and sometimes on their own fry. From the observation of Mr. Low of Birsa, it is probable that they likewise feed on flies. This gentleman assured Mr. Pennant that he had caught many thousands with a common trout fly, in a deep hole in a rivulet, into which the tide flows. He commonly went at the fall of the tide. They were young fish from six to eight inches in length.

Herrings continue in perfection from the end of June to the beginning of winter, when they deposit their spawn, and the number of eggs in each good herring amounts, according to Mr. Harmer, to thirty-six thousand nine hundred and sixty. When we consider this wonderful fecundity, we are no longer surprised at the immense shoals which visited the Scotch coast in 1773. It appears like romancing when we say that, from a tolerably accurate calculation, not less than 1650 boat-loads were taken in Loch Terridon every night.

This fish, whose importance in a commercial view must be acknowledged by every one, and which may justly be said to form one of the wonders of the northern world, is principally caught by the inhabitants of Great Britain off the Scotch and

Norfolk coasts; and the fishing is carried on by nets stretched in the water, one side of which is kept from sinking by means of buoys fixed to them at proper distances. The nets hang in a perpendicular position; and the fish, when they endeavour to pass through, are entangled in the meshes, where they remain till the net is hauled in. The nets are never stretched in the day-time, as they are then supposed to frighten the fish away; but as soon as the evening approaches, the fishermen again prepare their snare; and if the night proves dark, and the surface of the water is considerably ruffled by the wind, they are almost certain of great success. The nets are tanned, to strengthen them; and this is performed by putting them into a large vessel, and pouring upon them a quantity of hot liquor in which oak bark has been boiled: this process is repeated three times, and then the nets are supposed to last thrice as long as if this operation had not been performed.

The Dutch are said to have engaged in this fishery so long ago as the year 1164, and were in possession of it for several centuries. They are extravagantly fond of the fish, and observe its arrival on their coasts with as much joy as the Egyptians show on the first overflowing of the Nile. When pickled, it becomes their most delicious food: such, indeed, is the honour in which the memory of the first herring-pickler is held in Flanders, that the emperor Charles the Fifth paid his tomb a visit.

It has been justly observed by Mr. Pennant, as very singular, that most nations give the name of their favourite dish to the facetious attendant on every mountebank. Thus the Dutch call him Pickle Herring; the Italians, Macaroni; the French, Jean Potage; the Germans, Hans Wurst, (or Jack Sausage); and we dignify him with the title of Jack Pudding.

CARP.

GENERIC CHARACTER.

Teeth in the throat, none in the mouth.
Three rays in the gill membrane.
One fin on the back.

SPECIFIC CHARACTER.

CYPRINUS CARPIO. C. luteo-olivaceus, pinna dorsali lata, radio tertio postice serrato.
Yellowish olive, with wide dorsal fin; the third ray serrated behind.

COMMON CARP. . *Shaw Gen. Zool.* 5. p. 179. pl. 121. *Will. Ichth.* 245. *Penn. Brit. Zool.* 3. no. 165. pl. 70.

CARP are so remarkably tenacious of life, that with a little management they may be kept alive for many days after they are taken out of the water. Epicures sometimes feed them, during the colder season, in a cellar; and the following method, according to Dr. Forster, is the best that can be devised for that purpose. A carp is laid on a great quantity of fresh wet moss, spread on a piece of net,

which is then gathered into a purse, and the moss so contrived that the whole fish be entirely wrapped up in it; care, however, must be taken to give the fish ease, and not to squeeze it, so that it may have room to breathe in this confined attitude. The net, with the fish and moss, is then plunged into water, and hung up to the ceiling of the cellar. In the beginning this operation must be very frequently repeated, at least every three or four hours; by length of time the fish will be more used to the new element, and will bear to be out of the water for six or seven hours. Its food is bread soked in milk, which in the beginning must be administered in small quantities; in a short time the fish will bear more, and will grow fatter. Dr. Forster saw the experiment tried in a nobleman's house, in the principality of Anhalt-Dessau, and visited the fish daily, during the time it was kept in this manner. At the expiration of a fortnight it was dressed and served up at dinner, when every one present found it excellent in its flavour.

The carp is a thick fish, and usually grows in this country to the length of fifteen or sixteen inches, but in warmer climates it is said to attain a much larger size, and to weigh from twenty to forty pounds: the colours of the body are rich; the upper part of the back being of a deep yellowish olive, while the sides are tinged with gold, and the tail with violet. The scales are very large, and when in best season of a fine gilded hue. A single beard is seen on each side of the mouth, and above the

nostrils another pair, but these are much smaller and shorter. The lateral line is slightly curved, and marked with a row of blackish specks. The dorsal fin extends far towards the tail, which is slightly forked.

The carp is said to have been brought into England by Leonand Marschal about the year 1514, since which time it has continued to increase, and is now become a common fish. The haunts of these fish in the winter months are the broadest and most quiet parts of the river; but in summer months they lie in deep holes, under the roots of trees or hollow banks; they are extremely cunning, and frequently exhaust the patience of the angler. They are not only very shy of taking a bait, but will sometimes escape from a net, either by leaping over the sides, or by immersing themselves so deep in mud that the net will pass over them. This degree of cunning has gained them the name of the river fox.

The longevity of carp is very great: instances are upon record of their having lived to a hundred years; and Dr. Smith, in his Sketch of a Tour to the Continent, mentions some of these fish, which he met with at the prince of Condé's seat at Chantilly, that were silvered over with age, and so tame, that when any passengers approached their watery habitation, they used to come to the shore in such numbers as to heave each other out of the water, begging for bread, of which a quantity was always kept at hand on purpose to feed them. The ponds at Versailles

were stocked with the same in the reign of Louis the Fourteenth, where they probably remain at this time, unless, like the rest of the country, they have undergone a revolution.

These fish abound in the rivers and lakes of Poland and Germany, where they are taken of a large size. The traffic which is carried on in these countries has induced many of the nobility and others to be particularly attentive to the breeding of carp;—the merchants or dealers purchase the fish of the noblesse, who derive a considerable income from the produce of their ponds. We are indebted to Dr. Forster for a very full account of the method of managing carp on this large scale, and shall take the liberty of introducing as much of his paper from the Philosophical Transactions as will be sufficient for our purpose.

The doctor observes that the fish thrive best in ponds that are situated in a well manured fertile plain, surrounded by fine pastures and corn-fields of a rich black mould, having either mild or soft springs on the spot, or a rivulet that runs through the plain. The water ought to be mild and soft; by no means too cold, or impregnated with mineral particles; the full influence of the sun is very necessary to ensure success in breeding of the fish, and it is likewise highly proper that the pond be sheltered against the cold blasting easterly winds. The ground towards the pond ought to have a gentle slope; for the deep valleys are subject to great floods, and will then endanger the dikes in a wet rainy

season; and often the expectations of many years are in a few hours swept away.

It is found by experience most convenient to have three kinds of ponds for carp; the first is called the spawning-pond, the second the nursery, and the third, or largest, the main-pond. There are two methods of stocking the ponds with carp; either to buy a few old fish, and to put them into the spawning-pond, or to purchase a good quantity of one-year old fry for the nursery. A pond intended for spawning must be well cleared of all other kinds of fish, especially such as are of a rapacious nature, as well as of newts, or larvæ of lizards and of water-beetles, which frequently destroy quantities of the fry to the great loss of the owner. A pond of the size of about one acre requires three or four male carp, and about six or eight females. The best carp for breeders are five, six, or seven years old, in good health, in full scale, and without any blemish or wound; such as are sickly and move slowly in the water, have spots as if they had the small pox, have either lost their scales, or have them sticking but loosely to the body; whose eyes lie deep in their heads, are short, deep, and lean, will never produce a good breed. Being provided with a set of carp such as are here described, and sufficient to stock a pond with; it is best to put them on a fine calm day, the latter end of March, or in April, into the spawning-pond, where they will spawn in May, June, or July, according as the warm season sets in earlier or later. At this season they swim

to shallow, warm, and sheltered places, where the female deposits the spawn about the roots of grass, osier-roots, hanging branches, &c. The milter, or male fish, by a natural instinct follows the spawner, and the milt or soft row is spread over the spawn, which thus becomes impregnated. Carp at this season are frequently seen swimming, as it were in a circle, about the same spot. Providence has directed these fish to deposit their spawn on the finest and calmest summer days, that the fry of so useful a fish may be brought forth in security: if it had been otherwise, a stormy day would have washed it towards the banks, where it might have been eaten up by birds, or trampled on by men and quadrupeds, or dried up by the heat of the sun, and a whole generation of carp entirely destroyed. During the spawning season the carp may be approached, so that they will pass and repass between a person's hands held under the water, without being in the least disturbed; but if any noise or quick motion be made, they dart away with surprising velocity. Great care must be taken, during the spawning season, to prevent the approach of all aquatic fowl, wild and tame, to the ponds; for geese and ducks not only swallow the spawn, but destroy still more of it by searching among the weeds and aquatic plants: it is therefore a general rule to send twice a-day a man round the pond, to frighten away all wild fowl, such as swans, geese, ducks, cranes, and herons. A mixed breed is sometimes produced be-

tween crusians and carp, which are of a hardy nature, but seldom reach the size of other carp. The mules between carp and tench partake of the nature of both fish, grow to a good size, and have some parts of their bodies covered with the small slimy scales of the tench, while other parts have the larger scales of the carp. After the spawn are hatched, they are suffered to remain in the pond till the next spring, when they are removed to the nursery, or second kind of pond, where the young fry are brought up.

The best time to put them into the nursery is in March or April, on a fine and calm day; and it is necessary to send people all the first day round the pond, in order to drive the tender and weak fry from the sides, because they are bewildered in a strange place, and often become the prey of rapacious birds. If every thing goes on well, the fry will grow in two summers to the weight of four, five, and sometimes six pounds, and to be fleshy and well tasted. A great many Prussian gentlemen make a good profit by selling their carp after two years standing in the nursery, and export them even to Finland and Russia.

The main-ponds are the last kind. In these carp are put that measure a foot, head and tail inclusive. Every square of fifteen feet in the pond is sufficient for one carp, and will afford food, and room for the fish to play in. The more room carp have, and consequently the more food the pond

affords, the quicker will be the growth of the fish. Spring and autumn are the best seasons for stocking the main-ponds. During the winter, when the ponds are covered with ice, holes must be carefully made every day for the admission of fresh air; if this caution is neglected, the carp will frequently perish. In the summer season the ponds must be kept clear of weeds; but they must never be dragged in the spawning season, as that would be the destruction of thousands of fish. The best season for catching such carp as are intended for market is autumn. After the pond has been five or six years in constant use, the water should be let entirely off, to clear it of mud, which often increases too much and becomes a nuisance. When the pond is dry, it should be ploughed up before the frost sets in: this should be repeated in the spring, and oats or barley sown in it, which will repay the owner with a rich and plentiful crop. Some people sow a pond which has been dry for some months with oats; and when they are growing, fill it up with water, and introduce carp for spawning. This practice seems, however, to be more noxious than beneficial; for the growing oats, instead of affording nourishment, will decay, and communicate putridity to the water, which can by no means be salutary to the fish.

In some of the ponds Dr. Forster recollects to have seen carp above a yard long, and of twenty-five pounds weight, but he had no opportunity of ascertaining their real age. In the pond at Charlotten-

burg, a palace belonging to the king of Prussia, he saw more than three hundred carp between two and three feet long: he was told by the keeper that they were of between fifty and sixty years standing; they were tame, came to the shore in order to be fed, and swallowed with ease a piece of white bread of the size of half a halfpenny roll.

GOLDEN CARP.

SPECIFIC CHARACTER.

CYPRINUS AURATUS. C. aureus splendidissimus, pinnis rubris, cauda sæpius trifida, pinnaque ani duplici.
Brilliant golden carp, with red fins, tail frequently trifid, and vent fin double. *Shaw Gen. Zool.* 5. p. 209. pl. 126, 127.
CYPRINUS AURATUS. C. pinna ani gemina, caudæ transversa bifurca. *Linn. Fn. Suec.* 2. p. 125. pl. 2.
Cyprinus colore rubro. *Bloch,* pl. 93 and 94. f. 1, 2.

GOLDEN CARP. . *Penn. Brit. Zool.* 3. p. 374. no. 178. *Edw. Av.* t. 209. GOLD FISH.

THIS very beautiful species of carp was first introduced into England about the year 1691; since which time it has continued to increase, and is now become so completely naturalized, that it will breed as freely in the open pond as the common carp. We are indebted to the Chinese for this splendid fish, who take the most beautiful kinds in a lake in the province of Che-Ryang, situated near a mountain at a small distance from the town of Tchanghou. The beauty of their colours, and their active lively motions, make them the universal favourites of the ladies, who keep them for their amusement, either

in porcelain vessels, or in the small basons that decorate the courts of the Chinese houses. They provide for them an earthen vessel with holes in the sides, and turn it upside down in the basin where they are kept, that at any time when the sun is too powerful for them, they may have a place to which they can retire to avoid its influence. A very little food is requisite to support these fish, a few wafers being sufficient to nourish them for some time: they are occasionally fed with bread crumbs, small worms, the yolk of eggs dried and powdered, and other substances of the like nature. Their water should be changed three or four times a week, and the fish taken out with a net, as they are too delicate to bear handling.

We are told that in China, where the gold fish are kept in ponds, they are regularly fed, and taught to rise to the surface at the sound of a bell, in order to receive their nourishment. It is singular that the fry when first excluded should be quite black, after which they turn white, and then of a gold colour. The most brilliant colours are to be found on the smallest fish, which exhibit a rich metallic golden hue, with a cast of scarlet in the upper parts, and of silver on the lower. Some are perfectly white like silver, others have an irregular mixture of white spotted with red. All are beautiful while living, but lose their lustre when dead. The females are distinguished from the other sex by several white spots near the gills, and the pectoral fins.

Dr. Shaw remarks that no fish is subject to so

many variations in its domestic or cultivated state as the gold fish; not only the colour of the body, but even the form and number of the fins, differing greatly in different individuals. The Doctor observes that the back fin is sometimes wanting altogether, or consists only of a few rays united by their connecting membrane; the vent fin is very frequently double; and the tail, which even in its natural state is said to be often trifid, becomes still more strikingly so in the cultivated kind, and so formed as to appear horizontal, the middle part or lobe rising up between the side parts.

A whimsical way of exhibiting these fish is sometimes practised; a glass bowl is blown with a hollow space within, that does not communicate with it. In this cavity a bird is occasionally placed; so that a goldfinch or a linnet may be seen hopping as it were in the midst of the water, while the fishes are swimming in a circle round it.

TORPEDO.

GENERIC CHARACTER.

Body broad, flat, and thin.
Five apertures beneath on each side the neck.
Mouth beneath the head, transverse, and closely set with teeth.

SPECIFIC CHARACTER.

Raja Torpedo.	R. tota lævis. *Linn. Syst. Nat. Gmel.* 1. p. 1504. Quite smooth. Raja dorso monopterygio, cauda brevi apice pinnato, lævis, inermis, rostro subobtuso. *Gronov. Zooph.* no. 152.
Torpedo. . .	*Will. Ichth.* p. 81. t. D. 4. *Penn. Brit. Zool.* 3. p. 89. no. 36. pl. 10. *Shaw Gen. Zool.* 5. p. 297. pl. 146.

The wonderful power in this fish, to benumb the hand that touches it, has been known for many ages, and noticed by most writers. The antients admired the effect without attempting to explain the cause; and that this singular faculty might be rendered still more astonishing, they gave to it an influence which it by no means possesses. Thus Pliny assures us that the torpedo, even when touched

with a spear or stick, can benumb the strongest arm, and stop the swiftest foot. Oppian goes still further, and, with that license to which poets always think themselves entitled, makes it strike the fisherman through the whole length of his line and rod. Dr. Shaw has inserted the following elegant translation of the passage in his General Zoology :

> The hook'd torpedo, with instinctive force,
> Calls all his magic from its secret source :
> Quick thro' the slender line and polish'd wand
> It darts; and tingles in th' offending hand.
> The palsied fisherman, in dumb surprise,
> Feels thro' his frame the chilling vapours rise;
> Drops the lost rod, and seems in stiff'ning pain,
> Some frost-fix'd wanderer on the polar plain.

The torpedo is said to be found of a larger size in the Mediterranean than elsewhere. It will live four-and-twenty hours out of the sea, and exert its power, though in a fainter degree, till the last. It frequently buries itself in the sand, where it gives a very forcible shock, and often throws down the astonished passenger who inadvertently treads upon it. Mr. Pennant describes a small one about eighteen inches long, which was taken on our coast: the head and body, which were indistinct, were nearly round, about two inches thick in the middle, attenuating to extreme thinness on the edges; the ventral fins formed on each side a quarter of a circle; the tail was six inches long, and the two dorsal fins were placed near its origin; its two small eyes were placed near each other, and behind each of them was

a round spiracle, with six small cutaneous rays on the inner circumference; the mouth was small, and set with minute spicular teeth; the colour of the body cinereous-brown above and white beneath.

This appears to be the common size of our torpedo; but it occasionally grows much larger, specimens having been taken of the weight of fifty, sixty, and even eighty pounds.

Naturalists are much indebted to Mr. Walsh for his ingenious experiments relative to the electrical property of the torpedo: these experiments were conducted at Rochelle in France, in the year 1772, and the effects produced were found to be absolutely electrical, being subject to the same laws as electricity. The sensations likewise occasioned by the one and the other are precisely similar. Not only the shock, but the numbing sensation, which the animal sometimes dispenses, may be exactly imitated with the Leyden phial regulated by an electrometer, whose rod, to produce the latter effect, must be brought almost into contact with the prime conductor which joins the phial. Each effort of the animal to give the shock is accompanied by a depression of his eyes, by which even his attempts to give it to non-conductors can be observed; the rest of his body is almost motionless. Mr. Walsh has taken no less than fifty of the above-mentioned shocks from an insulated torpedo in the space of a minute and a half. All the experiments seem to prove that the effect the animal produces originates in a compressed elastic fluid, restoring

itself to its equilibrium in the same way, and by the same medium, as the elastic fluid compressed in a charged glass. Notwithstanding the weak spring of this animal electricity, Mr. Walsh was able, at the public exhibitions of his experiments at Rochelle, to convey it through brass wires interrupted by four persons, which number at times was increased even to eight. M. Seignette, mayor of Rochelle, and one of the secretaries of its academy, has thus related this curious experiment in the French gazettes for the month of October in the same year:

"A live torpedo was placed on the table. Round another table stood five persons insulated. Two brass wires, each eighteen feet long, were suspended from the ceiling by silken strings: one of these wires rested on the wet napkin on which the fish lay; the other end was immersed in a basin full of water placed on the second table, on which stood four other basins likewise full of water. The first person put a finger of one hand in the basin in which the wire was immersed, and a finger of the other hand in a second basin. The second person put a finger of one hand in this last basin, and a finger of the other hand in the third; and so on successively, till the five persons communicated with one another by the water in the basins. In the last basin one end of the second wire was immersed; and with the other end Mr. Walsh touched the back of the torpedo, when the five persons felt a commotion which

differed in nothing from that of the Leyden experiment, except in the degree of force. Mr. Walsh, who was not in the circle of conduction, received no shock. This experiment was repeated several times, even with eight persons; and always with the same success. The action of the torpedo is communicated by the same mediums as that of the electric fluid. The bodies which intercept the action of the one, intercept likewise the action of the other. The effects produced by the torpedo resemble in every respect a weak electricity. This exhibition of the electric powers of the torpedo, before the academy of Rochelle, was at a meeting held for the purpose in my apartments on the twenty-second of July 1772, and stands registered in the journals of the academy."

Mr. Walsh, in his paper on the subject in the Philosophical Transactions, has related some other experiments, the most interesting of which are the following: "A large torpedo, very liberal of his shocks, being held with both hands by his electric organs above and below, was briskly plunged into water to the depth of a foot, and instantly raised an equal height in the air; and was thus continually plunged and raised as quick as possible for the space of a minute. In the instant his lower surface touched the water in his descent, he always gave a violent shock, and another still more violent in his ascent; both which shocks, but particularly the last, were accompanied with a writhing in his body,

as if meant to force an escape. Besides these two shocks from the surface of the water, which may yet be considered as delivered in the air, he constantly gave at least two when wholly in the air, and as constantly one, and sometimes two, when wholly in the water. The shocks in water appeared, as far as sensation could decide, not to have near a fourth of the force of those which took place at the surface of the water, nor much more than a fourth of those entirely in the air.

"The torpedo was then put into a flat basket open at the top, but secured by a net with wide meshes, and in this confinement was let down into the water about a foot below the surface; being there touched through the meshes, with only a single finger, on one of his electric organs, while the other hand was held at a distance in the water, he gave shocks that were distinctly felt in both hands."

A very singular fact respecting the electric power of this fish is mentioned by Spallanzani. He assures us that the young torpedo can not only exercise its electric faculty as soon as born, but even while it is yet in the body of the parent. The Abbé dissected a torpedo in a pregnant state, which contained several roundish eggs of different sizes, and also two perfectly formed young ones, which, when tried in the usual manner, communicated a very sensible shock, and which was still more perceptible when the little animals were insulated by being placed on a plate of glass.

The electric organs of this curious fish are placed on each side of the head and gills, reaching from hence to the semicircular cartilages of each great fin. Each organ is about five inches in length, and at the anterior end about three in breadth; they are covered above and below with the common skin of the animal, under which are longitudinal fibres spread entirely over them.

SHARK.

Designed by W. Daniell.

Published by Messrs. Cadell & Davies London, March 1 1809.

SHARK.

GENERIC CHARACTER.

Body oblong, growing less towards the tail.
Skin very rough.
Mouth placed beneath the head, and set with several rows of sharp teeth.
Five apertures on each side the neck.

SPECIFIC CHARACTER.

SQUALUS CARCHARIAS.	Sq. dentibus triangularibus serratis. *Linn. Syst. Nat. Gmel.* 1. p. 1498. With triangular serrated teeth. Squalus capite subdepresso, rostro subacuto, pinnis pectoralibus maximis. *Gron. Mus.* 1. 138. *Zooph.* 143. Squalus corpore cinereo, dorso lato. *Bloch,* 1. p. 33. n. 119.
WHITE SHARK. . .	*Will. Ichth.* p. 47. t. B. f. 7. *Penn. Brit. Zool.* 3. p. 106. n. 42. *Shaw Gen. Zool.* 5. p. 322. pl. 148.

THE shark is by far the fiercest and most voracious of the finny tribe; he is formed for destruction, and, having a very strong appetite for mischief, is constantly seeking to gratify it. Thus he prowls about in the warmer parts of the ocean, to the great ter-

ror of the rest of its inhabitants, as well as to the human race; whose bodies have been too frequently buried in the stomach of this formidable creature.

The mouth of this animal exposes to our view a most terrific arrangement of teeth. They are of a wedge-shaped figure, very sharp-pointed, and serrated on the sides: from three to six rows of these terrible instruments of destruction are planted in each jaw, and the shark has the power of erecting or depressing them at pleasure.

This species sometimes exceeds the length of thirty feet. The head is large and of a depressed shape; the mouth and throat enormously wide, and capable of swallowing a very large body; but as the mouth is placed far beneath, the shark is obliged to incline very much on one side to seize his prey: the eyes are large, and the back broad and flat; the tail, which is exceedingly strong and active, is of a semilunar form, but the upper part is longer than the lower. The creature is enabled to swim with great swiftness on account of his large pectoral fins. The whole body is of a light ash colour.

This insatiable plunderer is extremely fond of human flesh, and will follow ships in warm climates to catch whatever may chance to fall overboard: a man who meets with this misfortune is said to perish without redemption, and it is singular that the same remark should have been made respecting this creature as of beasts of prey; namely, that he

constantly prefers the flesh of a negro to that of an European. It is on this account that the sharks are so assiduous in following the slave-ships from the coast of Africa to the West Indies, since the mortality which generally prevails on board those vessels gives them but too frequent opportunities of gratifying their savage appetite. We shall here relate two shocking instances of the constant attendance and great rapacity of these monsters. The master of a Guinea ship informed Mr. Pennant that a rage of suicide prevailed among his new-bought slaves, from a notion the unhappy creatures had, that after death they should be restored again to their families, friends, and country. To convince them at least that they should not reanimate their bodies, he ordered one of their corpses to be tied by the heels to a rope, and lowered into the sea; and though it was drawn up again as fast as the united force of the crew could be exerted, yet in that short space the sharks had devoured every part but the feet, which were secured at the end of the cord. This appetite for human flesh will occasion these animals to follow the slave-vessels into our colder latitudes. Some years ago a Guinea captain was, by stress of weather, driven into the harbour of Belfast, in Ireland, with a lading of very sickly slaves, who, in the manner above mentioned, took every opportunity to throw themselves overboard, when brought upon deck, as is usual, for the benefit of the fresh air. The captain, among others, perceiving a woman slave attempting to

drown herself, pitched upon her as a proper example to the rest. As he supposed that they did not know the terrors attending death, he ordered the woman to be tied with a rope under the armpits, and so let her down into the water. When the poor creature was thus plunged in, and about half way down, she was heard to give a terrible shriek, which at first was ascribed to her fears of drowning; but soon after the water appeared red all round her; she was drawn up, and it was found that a shark, which had followed the ship, had bit her off from the middle.

> "Lur'd by the scent
> Of steaming crowds, of rank disease, and death,
> Behold! he rushing cuts the briny flood,
> Swift as the gale can bear the ship along;
> And, from the partners of that cruel trade
> Which spoils unhappy Guinea of her sons,
> Demands his share of prey, demands themselves."

Swimmers frequently fall a prey to the voracious shark: those are lucky, who, like a gentleman well known in this city, escape with the loss of a leg or an arm. Many perish entirely by them, and are for ever swept away from their family and friends. The melancholy instance which happened in the island of St. Christopher's, and which forms the substance of a pathetic ballad by Grainger, should prove a warning to others not to trust themselves to the mercy of those seas. This ballad is so interesting, that we shall beg leave to introduce the latter part of it, where the person, of all others the

most dear to the unfortunate young man, comes to the shore to welcome his arrival.

Soon as the well known ship she spy'd
She cast her weeds away ;
And to the palmy shore she hied,
All in her best array.

In sea green silk so neatly clad,
She there impatient stood ;
The crew with wonder saw the lad
Repel the foaming flood.

Her hands a handkerchief display'd
Which he at parting gave ;
Well pleas'd the token he survey'd,
And manlier beat the wave.

Her fair companions one and all
Rejoicing crowd the strand ;
For now her lover swam in call,
And almost touch'd the land.

Then through the white surf did she haste,
To clasp her lovely swain ;
When, ah ! a shark bit through his waist:
His heart's blood dy'd the main !

He shriek'd ! his half sprang from the wave,
Streaming with purple gore;
And soon it found a living grave,
And, ah ! was seen no more.

Now haste, now haste, ye maids, I pray,
Fetch water from the spring :
She falls, she swoons, she dies away,
And soon her knell they ring.

Now each May-morning round her tomb,
Ye fair, fresh flowrets strew ;
So may your lovers scape his doom,
Her hapless fate scape you !

Hughes, in his Natural History of Barbadoes, mentions an instance of personal courage which will hardly be credited; yet as it rests on good authority we conceive it our duty to relate the story. In the reign of queen Anne a merchant-ship arrived at Barbadoes from England. Some of the crew were one day bathing in the sea, when a large shark appeared, and swam directly towards them. They were advertised of their danger from a person on board the ship; and immediately hurried towards the vessel, were they all arrived in perfect safety, except one poor fellow who was cut in two by the shark almost within reach of the oars. A comrade and most intimate friend of the unfortunate victim, when he observed the severed trunk of his companion, was seized with a degree of horror that may be more readily conceived than described. The voracious monster was seen traversing the bloody surface in search of the remainder of his prey, when the brave youth plunged into the water, determined either to make the shark disgorge, or to be buried himself in the same grave. He held in his hand a long and sharp-pointed knife, and the rapacious animal pushed furiously towards him: he had turned on his side, and opened his enormous jaws, in order to seize him, when the youth, diving dexterously under, seized the shark with his left hand, somewhere below the upper fins, and stabbed him several times in the belly. The shark, enraged with pain, and streaming with blood, attempted by every means in his power to disengage

himself from his enemy. The crews of the surrounding vessels saw that the combat was decided; but they were ignorant which was slain, till the shark, exhausted by loss of blood, reached the shore, and along with him his conqueror; who, flushed with victory, redoubled his efforts, and with the aid of an ebbing tide dragged him on the beach. The story concludes with saying that he ripped up the bowels of the fish, obtained the severed remains of his friend's body, and buried it with the trunk in the same grave.

A negro, armed with a sharp knife, will sometimes attack one of these dangerous animals, and generally with success. The Black is well aware of the shark's inability to hurt him unless he first turns upon his side; he therefore boldly ventures towards the creature; and while he is preparing to give the fatal gripe, the negro dives beneath and wounds him in the belly: these blows followed up with dexterity, soon put an end to the combat, and the victor returns to the shore in triumph. It is probably owing to their address in avoiding the attacks of so formidable an enemy, that the South Sea islanders are not at all afraid of sharks. Captain Portlock asserts that he saw five or six large sharks swimming about the ship at a time when upwards of a hundred Indians, both men and women, were in the water. It is singular that these ravenous animals, though they greedily seized the bait thrown to them by the sailors, never offered to molest the Indians; nor did they in their turn

manifest the least degree of fear at being in such alarming company.

Notwithstanding the voracious appetite of this fish, it sometimes requires a little address to catch him. The bait used for this purpose by our seamen is a piece of beef, or pork, firmly fixed upon a strong hook, attached to an iron chain; this is thrown into the sea, and the end made fast to the stern of the ship. In this situation it seldom remains long without a visitor, who examines the beef, and after swimming round will sometimes leave it untouched, as if apprehensive of the snare: when he appears thus undetermined, the sailors will draw the bait towards them, as if intending to take it entirely away; and this stratagem frequently succeeds: the hungry glutton, alarmed at the idea of losing it for ever, rushes forward to his destruction, and swallows the iron hook. When he finds this fatal instrument lodged within his maw, he exerts his utmost efforts to disengage himself; and finding it impossible to disgorge the hook, he tries with all his might to cut the chain: thus he continues his unavailing task, till, quite spent, he suffers himself to be drawn on board the ship, and dispatched. This enormous creature bears many hard blows before he is killed, and struggles terribly with his destroyers; who are careful to avoid being struck by his tail, with which he sometimes gives very dangerous blows.

M. Geoffroy has added something to the interesting part of Natural History, in his account of the

shark's supposed purveyor. This gentleman has inserted in the *Bulletin des Sciences*, No. 61, an observation he made during his voyage respecting the pilot fish*, who accompanies the shark, and points out to him those places where food is to be obtained in the greatest abundance. In the month of May, 1798, while M. Geoffroy was lying becalmed between Cape Bon and the Island of Malta, the attention of the passengers was excited by a shark advancing towards the vessel. He was preceded by two pilots, who were seen to direct their course towards the poop of the ship, which they inspected twice from one end to the other; but, not finding any thing there to satisfy the want of their master, resumed their former route. It appears that the shark never lost sight of the pilots, but regularly followed their course, as if he had been dragged by them. The minute the shark was seen, one of the sailors threw a large hook into the sea, baited with lard. The three travellers, though they had already proceeded to some distance, stopped short, upon hearing the noise which the bait made in falling into the water, and the two pilots were dismissed to examine the cause. While they were gone, the shark played upon the surface of the water, and occasionally dived, but always reappeared in the same place. The pilots, after they had discovered the lard, returned to their master with great velocity, and made every effort to get before him; which they had no sooner done than the trio returned to-

* *Gasterosteus ductor*, Linn.

wards the vessel. The shark, however, did not discover the bait till it was pointed out to him by his friends, when he rushed forward to seize it, and the hook penetrating his lip, he was immediately hoisted on board.

If we for a moment consider the fossil teeth of this species, preserved in the British Museum, which are at least four inches and a half from the point to the base, and six inches from the point to the corner; we shall be satisfied, that the specimen they belonged to must have been of a size far superior to any that are to be met with at present.

During the breeding season the sharks are observed to approach the shores, on purpose to choose a favourable spot where they may deposit their young. These are discharged two or three at a time, enclosed alive, in a capsule, or square pellucid horny case, terminated at the four corners by very long and slender filaments: the young when first excluded from these are not above a few inches long.

STURGEON.

SPECIFIC CHARACTER.

ACIPENSER STURIO. A. rostro obtuso; oris diametro transverso longitudini æquali, cirris rostri apici propioribus; labiis bifidis. *Linn. Syst. Nat. Gmel* 1. p. 1483.

Beak obtuse, with long cirrhi situated towards the end; mouth transverse; lips bifid.

Acipenser cirris quatuor corpore tuberculorum spinosorum seriebus quinqueangulo, rostro subacuto. *Gron. Zooph.* p. 39. no. 140.

ACIPENSER. *Bloch*, 3. p. 89. no. 1. pl. 88.

STURGEON. . . . *Will. Ichth.* 239. *Penn. Brit. Zool.* 3. p. 124. no. 53. pl. 19. *Shaw Gen. Zool.* 5. p. 370. pl. 159.

THE sturgeon inhabits the northern European and American seas, and annually ascends the largest rivers in order to deposit its spawn. The inhabitants along the banks of the Po, the Danube, and the Wolga, profit exceedingly by their visits; they crowd up the latter river during the autumn and winter, and are then taken in great numbers.

The sturgeon grows to the length of eighteen feet, and will sometimes weigh five hundred pounds, but they are seldom met with of so large a size in our rivers. Mr. Pennant mentions one that weighed four hundred and sixty pounds, which was taken a few years ago in the river Esk, in Scotland; where, he tells us, they are more frequently found than in our southern waters. They are represented as very spiritless, suffering themselves to be taken without the least resistance, and drawn out of the water without a struggle. Their flesh is admired for its firmness and delicacy, and when roasted is said to be extremely good. In the months of May, June, and July, the American rivers are full of them, and at that season they are seen sporting in the water, and leaping from its surface to a considerable height in the air. The noise made by their fall may be heard on a still evening at a great distance. We are assured that it is dangerous to pass the places that are much frequented by them, as they sometimes fling themselves into the small boats used upon the rivers, and sink them.

We receive most of our sturgeon either from the Baltic rivers, or North America. A large fishery has been long established at Pillau, in Prussia, where the adjacent shores are formed into districts and farmed out to different companies, some of which, according to Mr. Pennant, are rented for near three hundred pounds a year. They are caught in large nets made of small cord, which are stretched by the fishermen across the mouth of the

river, in such a manner, that, whether the tide ebbs or flows, the pouch of the net goes with the stream. Some of the sturgeon thus caught are carried to market and sold fresh, while others are pickled and sent to different parts of Europe, where they are much esteemed; particularly in England. There are two ways of preserving the fish. One is by cutting it in pieces lengthwise, and hanging it up to dry in the sun; in this state it is sold in all the countries of the Levant, and supplies the want of better provision. The other method is practised along the shores of the Baltic, and in Holland; where the fish is cut into short pieces, and packed in small barrels containing a proper pickle to preserve them in.

When the Indians fish for sturgeon, they generally use a pointed spear about fourteen feet long: with this instrument they embark in their canoe on one of the North American lakes; and when a fish passes, the man at the head darts the spear into the most vulnerable part of the body, which is carried away by the sturgeon with such velocity as instantly to run out a long coil of rope to which the end of the spear is fastened. If, however, the blow proves effectual, the fish is generally killed in a short time.

From the roe of this fish is prepared the *caviar*, so well known as a delicacy in some parts of Europe. In consistence it is said to resemble soft soap, and it is eaten with bread as a relish. This preparation has long fallen into disuse in England, but

is said to be still an article of merchandize among the Turks, Greeks, and Venetians. It is made, as we have just observed, of the roe, which the persons who are employed for the purpose separate from the fish; and having cleared it from the small membranes that connect it together, they wash it with vinegar, and afterwards spread it to dry upon a table. The spawn is then put into a vessel with salt, and broken into small pieces, after which it is removed into a canvass bag to drain; and lastly it is taken to a tub with holes in the bottom, where if there be any moisture still remaining it may run out. In this tub it is firmly pressed down, and covered up close for use.

The back and sides of the sturgeon are well guarded from injury by five rows of large bony tubercles, each of which is terminated by a sharp curved point, in a reversed direction. The skin is covered with very small tubercles of a similar form. This fish has a very long and slender nose, which ends in a point. The mouth is situated beneath, and is destitute of teeth: four long tendrils, or beards, are placed between this and the end of the nose. The manners of the sturgeon seem perfectly inoffensive; and he is said to be content with the marine insects which he finds at the bottom of the sea, as these are chiefly found in the stomach when the fish is opened.

It appears that the sturgeon was a celebrated fish among the antients, and so highly relished by the Greeks and Romans, that, according to Pliny, it

was brought to table with great ceremony, and ornamented with flowers; the slaves who carried it being also adorned with garlands, and preceded by music. The learned Mr. Pennant, however, has doubted whether the *acipenser* of the antients was the same as our sturgeon. Had they been of one species, it is hardly to be supposed that Ovid would have spoken of it as a foreign fish:

Tuque peregrinis, acipenser, nobilis undis.

And, thou, a fish in foreign seas renown'd.

He likewise founds his objection on the description of Pliny; for that philosopher relates, that its scales are placed in a contrary direction to those of other fish, being turned towards the mouth; which disagrees with the character of all that are known at present.

INSECTS.

THE excellent Stillingfleet says, "We are too apt to treat the Almighty worse than a rational man would treat a good mechanic; whose works he would either thoroughly examine, or be ashamed to find any fault with them." This observation is but too true; and we are confident that many are deterred from contemplating the minuter parts of the creation, from the fear of being ridiculed as hunters of butterflies, or collectors of cockles: but let it be remembered, that those who direct their wit against the naturalist, are far more to be pitied than he, who has a rational and innocent amusement to fly to, that will at once arrest his attention and improve his mind. He may be assured, that the variety, the dispositions, and the wonderful formation, of the little creatures we are about to describe, will afford him sufficient matter of astonishment; and, at the same time, compel him to allow, that what the Deity in his infinite wisdom hath thought fit to create, it can never degrade us to examine.

We cannot sufficiently admire that art which has associated so many vessels, and such activity of motion, in an insect which is frequently so small as hardly to be perceived. These minute points are considered by the vulgar as the mere effects of chance; while the naturalist looks up to the true author of their being, and finds in them a fresh proof of his omnipotence. Most of the tribe can boast a brilliancy of colouring, and many have a profusion of azure, green, and vermilion, gold, silver, and diamonds, with fringe and plumage upon their wings and the ornaments of their heads. We have only to examine a dragon fly, a papilio, or even a caterpillar, to convince us of this magnificence.

The Abbé La Pluche has given a very pleasing account of the different parts of insects. We are surprised, says the Abbé, to see nature so careful in the equipage and attire of these apparently insignificant little creatures; but our wonder would be different, if we were to take a particular survey of the organs she has given them for their support, and the implements each of them works with, according to their different professions—for every one has its own. Some spin, and have a couple of distaffs, and fingers to form their thread; others make nets and lawn, and for that purpose are provided with shuttles and clews of thread. There are some who build in wood, and are therefore supplied with two bills for cutting their timber; others make wax, and have their shops furnished with rakers, ladles, and trowels. Most of them have a trunk

more wonderful for its various uses than the elephant's, and which to some serves as an alembic for the distillation of a syrup man could never imitate. To others it performs the office of a tongue; many employ it as a drill for piercing; and the generality use it as a reed for suction. Several whose heads are fortified with a trunk, a saw, or a pair of pincers, carry in the other extremity of their bodies an auger, which they lengthen and turn at discretion; and by those means dig commodious habitations for their families in the heart of fruits, under the bark of trees, in the substance of leaves or buds, and frequently in the hardest wood itself. Most of them have excellent eyes, and have likewise the additional benefit of a couple of horns, or *antennæ*, that defend them, and which as the animal moves along, especially in the dark, prove the way, and discover, by a quick and delicate sensation, what would defile, drown, or endanger them. If these horns are moistened by any injurious liquor, or bend by the resistance of a solid body, the animal is warned of the danger, and turns another way. Some of these horns are composed of small knots, like those on the head of cray-fish; others terminate in the form of a comb: a third sort are covered with little plumes, or tufted with velvet, in order to be preserved from humidity. Besides these and many other benefits, which vary according to the species, most insects have also the gift of flying; some, as the dragon-fly, have four large wings, which correspond with the length of

their bodies; others, whose wings are of that exquisite fineness that the least friction would tear them, have two strong scales which they raise and fall like a pair of wings: but these are no more than a case for the real ones. You will find beetles, may-chaffers, and spanish flies, furnished with these cases. You may also observe numbers who have only two wings, but under these you will perceive as many bladders, or hollow vessels, which are thought by some to be a couple of weights, or a kind of counterpoise, by the assistance of which the insect supports itself against the agitation of the air, and continues in an equilibrium, like a rope-dancer who poises himself with a pole that has a weight of lead at each extremity; though perhaps these hollow vessels may answer the purpose of castanets, which the insects strike against their wings either for their diversion, or to make themselves known to each other by the buzzing sound.

Every insect is generated, like other animals, from a germ which contains the insect in miniature. This germ is at first wrapped up in a single or double covering, which opens when the animal has acquired strength enough to break through it. If the little creature escapes from its enclosure at the birth, and comes into the world completely formed, and like its dam, this latter is said to be viviparous. Of this species are the *palmer* and the *aphis*, so common upon rose trees, besides many others that are to be found on different plants. But when the female parent produces her young in a hard enclo-

sure, which is called an egg, and in which they continue for some time, she is said to be oviparous.

Among the viviparous species, the enclosure where the germ is lodged is soft and delicate; because, as the young is always invested with a cover while it continues in the womb of its mother, it is not requisite that the germ should have any stronger defence. In the oviparous kind, the covering which infolds the germ a little before the teeming of the dam, becomes a solid incrustation, to protect the young from the weight and injuries of the air, which rolls over the egg, as upon the surface of a vault, without occasioning the least prejudice to the tender animal that is lodged within. Most insects are of this last class, and are kept locked up in the egg during the winter.

The various contrivances which the females employ to secure their eggs from injury, and the care they take to deposit their little treasures in places where the future progeny may find subsistence, cannot be sufficiently admired. Many enclose their eggs in a web of the finest silk; others cover them with hair, or glue them to the leaves upon which they have been deposited, or make incisions into the leaves themselves, and deposit an egg in every slit. Some make a hole in the earth, where they lay their eggs, and some envelop them in a soft substance which forms the first nutriment of the animal. If this attention to secure the egg from injury is any evidence of an all-directing power, how much more so is that instinct in the little animal, which

causes it to place the egg in a situation, where the young will find its proper sustenance after it bursts from its confinement! The motions of these diminutive creatures may appear to a casual observer to be the effect of accident; but an attention to the following facts will convince him that they all tend to a certain point. In China, where the silk-worm feeds at large in the fields, her eggs are only to be found on the mulberry-tree. We never find upon the cabbage any eggs of that caterpillar who eats the willow, nor see upon a willow the eggs of any caterpillar who feeds upon cabbage. But, what is still more wonderful, neither the mulberry-tree, the willow, nor the cabbage, afford the parent moths or butterflies the smallest sustenance: they cannot taste their leaves, and yet they are directed by an unerring instinct to deposit their eggs upon those plants which are appointed for their food in the caterpillar state. The little moth, which does so much mischief to our curtains, woollen stuffs, and paper, is never to be found in a plant. Nor are the eggs of the flesh-fly to be found in any but animal substances. Thus is an invariable rule established, which is continued from one generation to another without the slightest deviation.

We shall conclude the subject of nidification with the following curious instance as related by an ingenious naturalist to the late Mr. Adams: "As I was observing one day some caterpillars which were feeding voluptuously on a cabbage leaf, my attention was attracted towards a part of the plant, about

which a little fly was buzzing on its wing, as if deliberating where to settle; I was surprised to see the herd of caterpillars, creatures of twenty times its size, endeavouring in an uncouth manner, by various contortions of the body, to get out of its way, and more so whenever the fly poised on its wing as if going to drop: at length the creature made its choice, and seated itself on the back of one of the largest and fairest of the cluster. It was in vain the unhappy reptile endeavoured to dislodge the enemy: its anguish now seemed intolerable, and I soon found it was in consequence of the wounds or strokes given by the fly: at every wound the poor caterpillar writhed and twisted its whole frame, endeavouring to disengage itself by shaking off the enemy, sometimes aiming its mouth towards the place; but it was all in vain, its little but cruel tormentor kept its place. When it had inflicted thirty or forty of these wounds it took its flight with a visible triumph; in each of these wounds the little fly had deposited an egg. I took the caterpillar home with me, to observe the progress of the eggs which were thus placed in its body, taking care to give it a fresh supply of leaves from time to time. It recovered to all appearance from the wounds it had received; and from that time for the space of four or five days seemed to live comfortably, feeding voraciously. The eggs were all hatched into small, oblong, voracious worms, which from the moment of their appearance fed on the flesh of the caterpillar, in whose body they were enclosed, and seemingly without

wounding the organs of respiration or digestion; and when they had arrived at their full growth, they ate their way out of the sides of the animal, at the same time destroying it. The caterpillar thus attacked by the larva of the ichneumon never escapes; its destruction is infallible: but then its life is not taken away at once; the larva, while it is feeding thereon, knows how to spare the parts that are essential to its life, because its own is at the same time tied up in that of the caterpillar."

How surprising it must appear to a person totally unacquainted with natural history, to be told, that there are a multitude of animals in different forms to be met with, some of whom live deep in the earth itself, others in the water, and who afterwards assume a new figure, live upon the surface of the ground, and creep like serpents through woods and fields; who after a certain period cease to eat, and build themselves habitations, or rather monuments of death, where they continue buried several weeks, and sometimes months and whole years, without motion or action, and to all appearance without life itself; and who, after all this, revive in the form of birds, and break through the enclosure of their sepulchres, unfold a most beautiful plumage to the sun-beams, and with expanded wings commence inhabitants of the air! Yet nothing is more certain, as all this takes place in the transformation of insects from the egg to the butterfly.

From the time the caterpillar first emerges from its shell, till it begins to spin its tomb, it is called

a *larva*, and in that state feeds voraciously upon the leaves of the plant where it is situated. Some of these *larvæ* are without, and others with feet; some of their bodies are covered with hair, and others with stiff bristles or hooks. Soon after they leave the egg, they increase very sensibly in bulk; and having continued in the larva state a certain time, they prepare themselves to appear under a new form.

Previous to their passing into the state of a *chrysalis**, the caterpillars cease to eat, and, after having fixed upon some spot where they may be as little exposed to danger as possible, begin to perform this great undertaking, by alternately extending and contracting their bodies to disengage themselves from the caterpillar skin. During this time they spin for themselves a little sepulchre, that varies according to the nature of the animal, but is built by each species in an uniform manner. In this enclosure they remain for a time apparently inanimate, and wrapped up in a case, through which, however, may be traced the rudiments of the future butterfly. Many of these little bodies are susceptible of warmth, and will move the tail part when placed in the hand.

The situations of these lodgments vary according to the species: some caterpillars bury themselves in the earth, and there remain till they are again called into life; others fix themselves in the cavities of

* Sometimes called a *nymph*, signifying a young bride, because the insect in that period puts on its beautiful attire, and prepares to assume the last form, in which it is appointed to multiply its species.

walls, or to the bark of trees; and there are some who enter even into the heart of the wood. We frequently observe them suspended to the roofs of houses, or to stakes in the hedges, where these curious little enclosures are formed by the caterpillar in the following manner: The creature begins the operation by extracting from her own substance a glutinous fluid, which lengthens, and acquires a due consistency in proportion as she advances her head from one place to another: when she has glued and interlaced several threads on some smooth place to which she intends to fix herself, she insinuates her hinder paws into a complication of the tissue, by means of the minute claws in which they terminate. In this manner she accomplishes her first fastening; after which she rears her head, and fixes a new thread on the lateral wood that corresponds with her fifth ring; then, with a gentle deflection of her head, she draws this thread in the form of a bow around her back, and fastens it to the opposite side. She frequently repeats these motions, in order to conduct the thread from the left to the right, and from the right to the left. When this second band, which sustains the animal above the middle of the body, has been sufficiently doubled and fortified, she rests upon it, and then agitates her body till it is entirely covered with sweat; after which her skin bursts and gradually shrinks away, while from the head of the chrysalis a set of little points are extended beyond the threads, that are sufficient, with the assistance of the band that

traverses the back, to connect the whole together till the proper season when the papilio is to be discharged from its confinement. If we open one of these cases, it will seem to present us with nothing but a kind of putrefaction, in which every thing is confounded; but then this mass contains the elements of a better state of existence, and composes the nutrimental juices which contribute to the growth of a more perfect animal. The time for its enlargement at last arrives, and the creature then forces its way through the prison that contained it. The head first disengages itself through the aperture, and the body follows: for a little while it continues moist and weak; but as the moisture evaporates the horns gradually lengthen, the legs and wings are extended, and at last the new animal, arrayed in all its glory, and in the full enjoyment of liberty, takes flight, and ranges through the air, without retaining the slightest similitude of its former condition.

The Abbé La Pluche has given a pleasing account of the industry of the young caterpillars which swarm in apple-trees, bushes, &c. The papilio which proceeds from these chooses some beautiful leaf, on which she fixes her eggs in autumn, and soon after dies, glued and extended upon her beloved family. The sun, whose rays have still some power, warms her eggs, and brings to life a multitude of little caterpillars, who without having ever seen their mother, and without the slightest model or instructions, immediately, with a kind of emulation, betake themselves to spinning, and with their

threads industriously weave themselves beds, and a spacious habitation, where they shelter themselves from the severity of the season, distributed into different apartments, without eating, and frequently without stirring abroad. There is only one little opening at the bottom of this mansion, through which the family sometimes take the air towards noon, in a fine sunshine, and sometimes in the night when the weather is settled. It requires some little strength to open their retreat and break the tissue that forms it, which is generally as firm as parchment, and not to be penetrated by rain, wind, or cold. In this apartment the whole family may be found reposing on a soft and thick down, and surrounded with several folds of the web they have spun, which at once supplies them with their quilts, their curtains, and their tent.

We shall conclude this short introduction with an explanation of the seven orders of Insects as they are divided by Linnæus. First, the order *coleoptera*, which consists of insects with crustaceous *elytra* or shells; these shells being strong and horny, and serving as cases, under which the fine transparent wings lie secure and completely concealed when the insect is at rest. This forms a very extended order, in which are included all the beetles.

The second order, *hemiptera*, are composed of insects having four wings, but the outer pair are partly crustaceous, and partly membranaceous; sometimes nearly the whole of the wing-cases are of a leathery texture, and softer than those of the first

order. The wing-covers likewise differ in another particular from the coleopterous insects; not meeting as they do in a direct line, but crossing each other when closed. Cock-roaches, locusts, grasshoppers, &c., belong to this order.

The order *lepidoptera* forms the third, and is named from the scaly winged insects which compose it. It includes the butterflies and moths, whose wings are covered with a powder which comes off upon the fingers, and, when examined by the microscope, affords a very pleasing and interesting spectacle, each particle of powder being as it were transformed into a regular fan-shaped scale terminated by four or five minute points.

Neuroptera, or nerve-winged insects, compose the fourth order, and are finely exemplified in the dragon-fly, which is so common by the sides of our rivers. The wings are four in number, and are reticulated, or appear like net work: they are beautifully transparent, and of the texture of fine gauze.

The fifth order is called *hymenoptera*, from the wings being membranaceous. The bee and wasp tribe, so well known for their stinging propensities, are arranged in this order. The insects we have hitherto mentioned are all provided with four wings; but we now proceed to the order of

Diptera, in which the insects have only two. But in the place of a second pair, they are furnished with poisers or balancers, which we have already

described as a kind of counterpoise, by the assistance of which the insect supports itself against the agitation of the air, and continues in equilibrium.

The seventh order, *aptera*, contains all those insects which are totally destitute of wings; such as spiders, centipedes, &c.

HERCULES BEETLE.

Designed by W. Daniell.

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COLEOPTEROUS INSECTS.

HERCULES BEETLE.

GENERIC CHARACTER.

Antennæ or horns terminated in a kind of club, divided longitudinally into different plates.

Second joint of the fore-legs armed with spines or teeth.

SPECIFIC CHARACTER.

Scarabæus Hercules. S. thoracis cornu incurvo maximo, subtus barbato unidentato, capitis recurvato, supra multidentato. *Linn. Syst. Nat. Gmel.* 1. p. 1526.

Thorax armed with a large incurved horn bearded beneath, and having a single tooth; head armed in the same manner, but the horn is shorter, and has several teeth.

Rhinoceros Americanus cinereus, rostro nigro nitente. *Petiv. Gazoph.* t. 70. f. 1.

Scarabæus scutellatus niger, &c. *Degeer. Ins.* 4. p. 304. no. 2. pl. 18. f. 9.

HERCULES BEETLE. . *Drury Ins.* 1. pl. 30. f. 1, 2. *Edwards Glean.* pl. 334. *Shaw Gen. Zool.* 6. p. 19. pl. 1.

THIS beetle is more remarkable for his size than for any thing interesting in his history. He is a most formidable-looking insect, and sometimes measures five or six inches in length. When he flies, the vibrations of his wings may be heard at a considerable distance. The surface of the wing-covers in this species is perfectly smooth, and their dark ground-colour is generally studded with spots of a still darker tint. Nothing can exceed the blackness of the head and limbs, except the colour of the horns, which are merely horizontal continuations of the thorax and the head. Our temperate climates are not visited by this enormous species, but in several parts of South America they are said to abound; and great numbers, we are informed, collect together on the mammee tree, where they employ themselves in rasping off the rind from the tender branches, in order to get the sap, of which it seems they are so very fond, that they drink to intoxication, and thus fall senseless to the ground. This account, however, has been doubted by a learned entomologist; who very properly remarks, that the beard in this case would be rubbed off the under surface of the large horn, in consequence of the friction to which it must necessarily be exposed by the insect removing the rind from the tree. The two sexes resemble each other in every re-

spect, except in the most prominent features, the horns, which nature has confined to the brow of the male.

This species yields to none in point of size, except indeed its African brother, the Goliah beetle, whose body is somewhat larger, and who likewise boasts more brilliant colours; having a rose-coloured thorax, marked with black stripes, and wing-cases of a fine purple-brown.

COCK-CHAFER.

SPECIFIC CHARACTER.

Scarabæus Melolontha.	S. scutellatus muticus testaceus, thorace villoso, cauda inflexa, incisuris abdominis albis. *Linn. Syst. Nat. Gmel.* 1. p. 1562.
	Testaceous escutcheon, the thorax downy, tail inflected, white notches on the abdomen.
Cock-chafer.	*Albin. Ins.* 60. *Degeer. Ins.* 4. pl. 10. f. 14. *Merian. Europ.* 1. p. 2. f. 4. *Shaw Gen. Zool.* 6. p. 21. pl. 3.

This well known insect is by far the most numerous of all the beetle tribe, and is highly deserving of attention on account of the ravages which it sometimes commits: we shall therefore trace its history from the egg, and conclude with some account of its calamitous visitations.

The female, at the appointed season, bores a hole in the ground, in which she deposits her eggs, which are of an oblong shape, and are generally placed with great regularity by the side of each other. After this very necessary operation is performed, she concerns herself no further about the eggs, but

again returns to her usual haunts among the leaves of some neighbouring tree, where she lies concealed and sheltered from the heat till the declining sun invites her to come forth and buzz about the branches.

When the eggs, which are thus deposited, have lain their due time in the earth, the little grubs break their shells, and soon begin to consume the roots of every vegetable within their reach. Their voracity increases with their size till they arrive at their full growth, when they are about an inch and a half long; the larva being a thick maggot of a whitish yellow colour, with six legs, and a large red head provided with a pincer, and a semicircular lip, with which it cuts the roots of plants and extracts the moisture. These destructive insects continue in this state between three and four years, during which time they work their way under ground with great facility, destroying the roots of our nutritive vegetables in a most deplorable manner. A whole field of fine flourishing grass, according to Mr. Anderson, has in the course of a few weeks become as brittle as hay, by these voracious grubs devouring the roots, and gnawing away the fibres. In these cases the turf becomes rotten, and may be turned up with the greatest ease; when the grubs will be found an inch or two under the surface, lying in a curved position upon their backs, with only their heads and tails above the surface of the mould. Instead of eyes, which to an insect entirely confined to a subterraneous

habitation must be useless, the grub is provided with a pair of feelers, which serve it to trace its way, and to discover any obstacle or danger which it may be necessary to avoid.

After this insect has been an inhabitant of the earth for more than three years (during which time it has often shifted its skin), it prepares to emerge from its dark abode, in a very different form. This, however, is not effected in a hurry, but requires months to accomplish. About the end of autumn, when the grub feels the time approaching for its transformation, it prepares for the change by digging deep into the earth, sometimes as far as six feet below the surface, where it takes some pains to form a smooth and capacious tomb, and soon after changes into a chrysalis. In this state the insect continues all the winter, and about the middle of February it again rises into life, and leaves its sheath completely winged; but by no means in a state to fly. All the operations of this creature seem to be tedious. Other insects, when they emerge from their temporary tombs, feel but little inconvenience, and are presently enabled to join their companions in the air: but this is for a long time a helpless animal; and far from at once enjoying a state of full perfection, it continues for a time feeble and sickly, with hardly power to move, and no inclination to eat. All the parts of its body continue soft for about a month; when they begin gradually to harden, and in May the insect leaves the ground, recovered from its state of imbecility.

At this season an interesting writer describes them as rising from their long imprisonment, from living only upon roots, and imbibing only the moisture of the earth, to visit the mildness of the summer air, to choose the sweetest vegetables for their banquet, and to drink the dew of the evening. If an attentive observer then walk abroad, he will see them bursting up before him in his path-way, and every part of the earth that had its surface beaten into hardness, perforated by their egression. When the season is favourable for them, they are seen in the evening by myriads buzzing along, and, with a sort of capricious blindness, hitting against every object that intercepts their flight.

These insects are the amusement of children, but the bane of husbandmen and gardeners; for swarms of them occasionally appear, to the destruction of every vegetable in their neighbourhood. When they multiply in this manner they are as much to be dreaded as a flight of locusts, and the mischief they do is equally calamitous. An instance of their destructive power, when collected in large numbers, is recorded by Mr. Molineux, in the Philosophical Transactions for the year 1697. From this gentleman's information, we learn that several districts in Ireland were overrun by these voracious insects, and that they were first noticed in the year 1688. The account is altogether so singular and curious, that we shall beg leave to give it nearly in the words of the author. The flight of cock-chafers first appeared on the south-west coast of Galway,

where they were brought by a south-west wind. From hence they penetrated into the inland parts towards Heddford, about twelve miles north of the town of Galway; multitudes of them appeared, in the day time, among the trees and hedges in the adjacent country, hanging by the boughs in clusters, like bees when they swarm. In this posture they continued, with little or no motion, during the heat of the day; but towards evening, or sunset, they would all disperse and fly about with a strange humming noise like the beating of distant drums, and in such vast numbers that they darkened the air for the space of two or three miles square. Persons travelling on roads, or abroad in the fields, found it very troublesome to pass through them, as they continually flew against their faces with such force, that they made the place smart, and left a slight mark behind them. In a short time after their arrival they had so entirely eaten up and destroyed all the leaves of the trees for some miles round, that the whole country was left as bare as in the depth of winter; and we are assured by Mr. Molineux, that the noise which this immense swarm of cock-chafers made in gnawing the leaves very much resembled the sawing of timber. They also came into the gardens, and destroyed the buds, blossoms, and leaves of all the fruit-trees, so that they were left perfectly naked; and many that were more delicate than the rest, lost their sap as well as their leaves, so that they gradually withered away and died. The multitudes of these insects

spread to such a degree that they infested houses, and became extremely offensive and troublesome. Their numerous young, hatched from the eggs which they had lodged under ground, near the surface of the earth, did still more harm in that close retirement than all the flying swarms of their parents had done abroad; for this destructive brood, lying under ground, ate up the roots of corn and grass, and thus consumed the support both of man and beast. This plague was happily checked several ways. High winds and wet mizzling weather destroyed many millions of them in a day; and when this state of the air prevailed, they were so weakened that their feet refused to support them, and they dropped from the branches completely disabled. During this unfavourable weather the swine and poultry of the country would watch under the trees for their falling, and feed and fatten upon them; and even the poorer sort of the country people, who at that time suffered from a scarcity of provision, had a way of dressing them, and lived upon the food. In a little time it was found that smoke was very offensive to them, and by burning heath, fern, &c. the gardens were secured; or, if the insects had already entered, they were thus driven out again. Towards the latter end of summer they returned of themselves, and so totally disappeared, that in a few days you could not see one left.

A year or two ago, continues Mr. Molineux, all along the south-west coast of Galway, such infinite numbers of these creatures were found dead

on the shore, and in such vast heaps, that upon a moderate calculation there could not be less than forty or fifty horse-loads. This was a new colony, or a supernumerary swarm, from the same place whence the first stock came in 1688, driven by the wind from their native land, which this gentleman concludes to be Normandy, or Britany in France, on account of the numbers with which that country is infested. This swarm, he supposes, met with a contrary wind, and, being tired with their voyage, were all driven into the sea, which, by the motion of its waves, cast their floating bodies in heaps on the shore. It was observed that they seldom kept above a year together in a place, and their usual stages or marches were computed at about six miles in twelve months.

In the month of February, in the year 1574, Mouffet tells us, that such an amazing number of these insects were driven into the river Severn, that the mills were completely clogged up, and prevented from working. The people were assisted in their attempts to extirpate these creatures by the birds, which hovered about in numbers, and feasted sumptuously upon them.

The county of Norfolk seems to have suffered more from the ravages of these insects than any other part of England. In the year 1751, a farmer was so injured by them, that he completely lost his crop, and was induced to receive a sum of money for the support of himself and family till the returning season. This man affirmed, that with the as-

sistance of his servant he collected eighty bushels of cock-chafers upon his own farm.

We are much indebted to our rookeries for preventing the increase of these destructive insects. While the land is ploughing the rooks may be observed to follow at a little distance, and pick up the grubs and other worms from the newly turned up furrow. In this manner great numbers are destroyed before they arrive at their winged state; and when that period takes place they may be easily reduced by shaking the trees where they lodge, in the middle of the day; for at that time they are quite stupid, and will fall to the ground without attempting to fly away. Those who employ themselves in this manner perform a very acceptable service to the husbandman, by crushing the future progeny in the body of the parent insect.

PILL-CHAFER.

SPECIFIC CHARACTER.

SCARABÆUS PILULARIUS. S. niger opacus lævis subtus æneus, thorace posterius rotundato. *Linn. Syst. Nat. Gmel.* 1. p. 1555.

Smooth; of a dusky black above, and brassy colour beneath; posterior part of the thorax rounded.

Copris niger nitidus, &c. *Geoffr. Ins.* 1. p. 91. no. 7.

PILL-CHAFER. . . . . *Catesb. Carol.* 3. pl. 11. left-hand figure. *Schæff. Ic.* pl. 73. f. 6. *Voet. Coleopt.* t. 28. f. 49.

THIS insect has obtained the name of *tumble dung beetle*, from the dirty drudgery to which the greatest part of its life is devoted. It is found both in Europe and America, and particularly demands our attention on account of its singular manners. The name of pill-chafer is likewise justly given to these creatures from their indefatigable perseverance in rolling up pellets of dung, like pills, in the centre of each of which they deposit an egg. It seems that they are directed by an exquisite sense of smelling to newly fallen dung, to which they resort in swarms, and immediately begin to temper it with

a proper mixture of earth, till it is formed into the pellets we have just mentioned, and each ball has received its egg. Mr. Catesby assures us, this employment so completely occupies their attention, that they may be handled, or otherwise interrupted, without being deterred; for the moment they are disengaged they continue their work without any apprehension of danger.

These insects are seen from April to September: after this period they disappear, and their eggs, which are conveyed to the depth of two or three feet beneath the surface of the earth, remain there till the following spring, when they burst their shells, and fill up their time in the same nasty manner as their parents did before them.

The pains which these creatures take to bury their pellets, and the way in which they proceed to effect their purpose, is thus described by Mr. Catesby, who observed the whole process:

"I have attentively admired their industry, and mutual assisting of each other in rolling these globular balls from the place where they made them to that of their interment, which is usually the distance of some yards, more or less. This they perform breech foremost, by raising their hind parts, and forcing along the ball with their hind feet. Two or three of them are sometimes engaged in trundling one ball, which, from meeting with impediments, on account of the unevenness of the ground, is sometimes deserted by them. It is, however, attempted by others with success, unless

it happen to roll into some deep hollow or chink, where they are constrained to leave it; but they continue their work by rolling off the next ball that comes in their way. None of them seem to know their own balls, but an equal care for the whole appears to affect all the community. They form these pellets while the dung remains moist, and leave them to harden in the sun before they attempt to roll them. In their moving of them from place to place, both they and the balls may frequently be seen tumbling about over the little eminences that are in their way. They are not however easily discouraged, and, by repeating their attempts, usually surmount the difficulties.

These insects are about an inch in length, and so strong, that when one or two of them are put under a candlestick they will cause it to move backwards and forwards, to the great surprise of those that are not aware of the trick.

STAG-BEETLE.

GENERIC CHARACTER.

Antennæ club-shaped, compressed on one side, and divided into short plates or laminæ resembling the teeth of a comb.

Jaws strong, projecting from the head, and armed with teeth.

SPECIFIC CHARACTER.

LUCANUS CERVUS.	L. scutellatus: maxillis exsertis apice bifurcatis latere unidentatis. *Linn. Syst. Nat. Gmel.* 1. p. 1588.
	With an escutcheon: each horn has a bifurcated apex and a single tooth turning inwards.
	Lucanus mandibulis exsertis unidentatis apice bifurcatis, labio deflexo: ruga transversali clavata. *Fabr. Ins.* 1. p. 1. no. 2.
	Platycerus fuscus, &c. *Geoff. Ins.* 1. p. 61. no. 1. pl. 1. f. 1.
	CERVUS VOLANS. *Mouff. Ins.* 148.
STAG-BEETLE. . .	*Merian. Eur.* pl. 168. *Schæff. Icon.* pl. 133. f. 1.
	STAG-CHAFFER. *Shaw Gen. Zool.* 6. p. 27. pl. 6.

THIS is the largest of our British insects, and is found in the neighbourhood of oak-trees, feeding upon the honey dew which so frequently moistens

the leaves. This formidable-looking beetle sometimes measures more than two inches in length, including the horns, which are a pair of very strong pincers, and of great use to the animal. The larva is generally found in the hollows of decayed oak-trees, where it lives among the rotten or decayed vegetable mould with which those cavities usually abound. The size of the insect in this state is very considerable, sometimes measuring nearly four inches. It is said to be five or six years in arriving at its full dimensions; after which it prepares for its second state, by rolling itself round in the earth, till, with the help of a glutinous fluid which exudes from its body, it has formed a hollow, in which, after a certain time has expired, it becomes a chrysalis. The ball of earth which contains the future beetle is said to be considerably larger than a hen's egg, and perfectly smooth within side. In the months of July and August these insects burst from their tombs completely formed, and of a deep chestnut colour.

DEATH-WATCH.

GENERIC CHARACTER.

Antennæ filiform; with the three last articulations longer than the others.

Thorax nearly round, with a distinct margin into which the head is occasionally received.

SPECIFIC CHARACTER.

PTINUS PULSATOR. Pt. cylindricus opacus rugosus maculis griseis adspersus. *Linn. Syst. Nat. Gmel.* 1. p. 1605.

Of a cylindrical figure, with a rough dark-coloured body marked with grayish spots.

DEATH-WATCH. . PTINUS FATIDICUS. *Shaw Gen. Zool.* 6. p. 33. pl. 8. *Nat. Misc.* 3. 804.

SUPERSTITION has for ages attached to this little insect the power of foretelling the approaching death of some friend or relative; and so strongly is the idea of its prophetic warning impressed upon the minds of many, that even in these enlightened days they still maintain their opinion, and refuse to divest themselves of their prejudice. These dreadful forebodings, conveyed perhaps from the head of the bed, or from behind the paper of the room, are oc-

casioned by the death-watch beating with firmness against the place. How groundless are our fears, and how opposite the intention of the innocent cause of all our apprehensions! His ticking noise, far from being the harbinger of ill, is giving him by nature as a signal to attract his wandering mate, and lead her towards the place where he is stationed.

We learn from Dr. Shaw, that it is chiefly in the advanced state of spring when this alarming little animal commences its sound, and that the prevailing number of distinct strokes which it beats is from seven to nine, or eleven. These beats are given in quick succession, and are repeated at uncertain intervals. The sound may be exactly imitated by striking the finger nail upon a table; and in old houses, where these insects frequently abound, their noise may be heard at almost every hour in the day.

We have not hitherto been fortunate in our endeavours to find this little object; we have frequently heard it, and have often attempted to trace it to its hiding-place; but it has always eluded our pursuit, and left us to regret our want of success. Mr. Stackhouse, who, after a diligent search to discover one of these insects, at length found it on the bottom of his chair, has thus described the manner in which it proceeded to make the noise: The death-watch raised itself upon its hind-legs, and, with its body somewhat inclined, beat its head with great force and agility against the place where it stood. The chair bottom was of sedge, and this was strip-

ped of its outward coat for the space of half an inch by the insect, which stood upon the bulbous part, and beat upon the outside with such force, that it was visibly depressed where it had beaten, for a space equal to the size of a silver penny. Mr. Stackhouse put the insect into a box, which he opened on the following day, and set in the sun. The little animal seemed very brisk, and crept backwards and forwards along the pieces of sedge and rotten wood that had been put into the box with it; till at length, getting to the end of one of the pieces, it extended its wings, and was about to fly, when Mr. Stackhouse shut down the lid and again secured his prisoner, which soon afterwards became quiet. "I could not before perceive," says this gentleman, "though I had the use of a tolerably good glass, any the least sign of a fissure upon its back; and for that reason did greatly question whether it had any wings or not, till I set it in the sun. The head of the insect appears to be of a very fine contexture, as it is seen when it creeps about and stretches it forward; but when it is drawn up under its galea it seems to be covered with a membrane thick set with fine hairs. It lived with me about a fortnight, but I could never perceive that it beat after it was confined in the box." The animal greatly resembles the colour of decayed wood, being of a dull grayish brown, and having several marks upon the wing-cases of a lighter cast. The length of the insect is about a quarter of an inch.

Dr. Shaw very properly observes, that we ought

to be careful not to confound this animal, which is the real death-watch of the vulgar, with a much smaller insect of a very different genus, which makes a sound like the ticking of a watch, that is generally continued for a considerable time without intermission. This is the *termes pulsatorium* of Linnæus.

If the finger nail or the head of a pin is struck upon a table within the hearing of a death-watch, it will frequently answer, and continue to do so at intervals for a considerable time. Dr. Derham assures us, that he frequently amused himself in this way with a male and female which he kept together in a box: by imitating their noise, he made them beat whenever he pleased. These little things are not without their mutual attachments. They continued quietly in their prison for about three weeks, when one of them died; and the other, unable to bear the confinement without its companion, gnawed through the box and escaped.

GLIMMER-CHAFER.

GENERIC CHARACTER.

Antennæ club-chaped, stiff, and shorter than the head.
Eyes four, two on the upper, and two on the under side of the head.

SPECIFIC CHARACTER.

Gyrinus Natator.	G. substriatus. *Linn. Syst. Nat. Gmel.* 1. p. 1611. Substriated. Dytiscus ovatus glaber, antennis capite brevioribus obtusis. *Scop. Ent. Carn.* 299. Scarabæus aquæ subrotundus e cœruleo viridi splendente undique tinctus. *Raj. Ins.* p. 89. no. 9.
Glimmer-chafer.	*Geoff. Ins.* 1. pl. 3. f. 3. *Roes. Ins.* pl. 31. *Schæff. Elem.* t. 67. *Shaw Gen. Zool.* 6. p. 39. pl. 11.

This common inhabitant of our brooks and rivers is seen sporting near the surface in the summer season, and shining like a piece of looking-glass. They are so quick in their motions, and dive with such velocity that they are not easily caught, although the water sometimes literally swarms with them. The glimmer-chafer is a small insect, sel-

dom exceeding the third of an inch in length; it is of an oval figure, and has acquired its specific name from the shining surface of its back, which glistens in the sun. It has been observed, that where these insects swarm, and the weather is very hot, they exhale a strong and disagreeable smell.

The eggs of these diminutive animals are deposited in the form of small white specks on the stems of aquatic plants, and the larvæ which are produced from them are really curious. Dr. Shaw's description of their figure, &c. is as follows:

"The larva is of a highly singular aspect, having a very lengthened body, furnished, exclusive of six legs on the fore parts, with a great many lateral appendages, or processes down the body; those towards the extremity considerably exceeding the rest. In its motions it is extremely agile, swimming in a kind of serpentine manner, and preying on the smaller and weaker water insects, minute worms, &c.; the head is armed with a pair of forceps, pierced on each side the tip with a small foramen, through which it sucks the juices of the animals on which it preys: the colour of this larva is a very pale or whitish brown, with a high degree of transparency, which renders it a highly curious object for the microscope: its length, when full grown, is about three quarters of an inch. When the time of its change arrives, it forms for itself a small oval cell, or case, on a leaf of sedge, or other

convenient water-plant, and after casting its skin becomes a chrysalis: this change usually takes place in the month of August, and the complete insect emerges in that of September."

The glimmer-chafer effects its rapid gyrations in the water with the hind legs, which are very broad, and act like a pair of oars.

GRAVE-DIGGING BEETLE

GENERIC CHARACTER.

Antennæ small at the base, but gradually thickening towards the end.

The elytra or wing-cases have a margin, with which the thorax is likewise provided.

The head is prominent.

SPECIFIC CHARACTER.

SILPHA VESPILLO. . . S. oblonga atra, clypeo orbiculato inequali elytris fascia duplici ferruginea. *Linn. Syst. Nat. Gmel.* 1. p. 1616.

Of an oblong shape and black colour; shield circular and unequal; wing-cases marked with two ferruginous bands.

NICROPHORUS ATER. Elytris fascia duplici ferruginea. *Fabr. Ins.* 1. p. 84. no. 2.

DERMESTES VESPILLO. *Scop. Ent. Carn.* 33.

GRAVE-DIGGING BEETLE. *Geoff. Ins.* 1. pl. 1. f. 5. *Roes. Ins.* 4. pl. 1. f. 1, 2. *Schæff. Icon.* pl. 9. f. 4. *Shaw Gen. Zool.* 6. p. 50. pl. 14.

THE singular manners oft his insect, as recorded by naturalists, are well worth our attention. Moles, birds, &c. are presently buried in the earth by the

indefatigable exertions of this beetle. Three or four of them, by their united efforts, will dig a hole in the ground and bury a mole under the surface, so that no traces of it shall be left; and this we are assured has been accomplished in the space of one hour. Mr. Gleditsch was induced to watch the motions of these industrious insects with more than common attention, as he was unable for some time to account for the disappearance of the dead moles which were left upon the ground; and his curiosity was so far excited to determine the cause of this singularity, that he was resolved if possible to find it out. Accordingly he procured a dead mole, which he laid upon some soft moist earth in his garden. This was done on the twenty-fifth of May, and in two days the mole was sunk four fingers' breadth into the earth. Mr. G. remarked that the position of the animal was not in the least altered, and that the dimensions of its grave corresponded exactly with the size of its body. The next day the grave was half filled up; and our narrator, to satisfy his curiosity, cautiously drew out the mole, which was in a very offensive state, and found directly under its body some little holes, in which were four of these beetles. After having returned the little grave-diggers into the hollow, where they presently concealed themselves among the earth, he replaced the mole precisely in its former situation, and, spreading a little soft earth over the remains, left it to its fate for the space of six days. Upon revisiting the body he found it completely corrupted, and filled

with small thick whitish worms, which proved to be the larvæ of the beetles. Thus he was led to believe that these insects had buried the mole on purpose to lodge their future offspring in its body.

Mr. Gleditsch, feeling inclined to investigate this curious business in a more particular manner, provided a glass vessel half filled with moist earth, into which he put the four beetles already mentioned and their progeny. The vessel, covered with a cloth, was placed on the ground, and in the space of fifty days the four industrious grave-diggers interred the bodies of four frogs, three small birds, two grasshoppers, and one mole, including the entrails of a fish, and two small pieces of the lungs of an ox. The method which these insects pursue to accomplish their purposse may be sufficiently exemplified in the body of a linnet, which, after being dead six hours, was placed by Mr. G. in the middle of the glass vessel, and in a very few moments was visited and examined by the beetles. In a few hours two of the beetles only remained with the bird, and the largest of these was suspected to be a female. After attentively surveying their work, they began by hollowing out a cavity of the size of the bird, by working underneath it, and removing the earth from the body as they proceeded. This they accomplished by leaning themselves strongly upon their collars, and bending down their heads to assist their efforts; thus forming, as it were, a rampart of mould round the linnet. The bird appeared to move alternately its head, its tail, its

wings, or its feet; and whenever these movements occurred, the beetles might be seen attempting to drag the body by its feathers into the grave, which was now nearly completed. After they had been full two hours at this work, the male beetle drove his mate away, and would by no means suffer her to return to her employment, though she frequently attempted it; for whenever she stirred from her hole he directly sent her back again.

It appears that the male continued to work by himself for at least five hours, in which time he removed an astonishing quantity of earth:—but if our observer was surprised at this instance of his strength, he was more so when he saw this diminutive creature stiffen his collar, and, by an extraordinary exertion of his powers, lift up the bird, make it change its place, and in some measure arrange it in the spacious grave which he had prepared for its reception. Every now and then the beetle mounted upon the body and appeared to tread it down, then again renewed his efforts, and drew it a little further into the earth till it was sunk to a considerable depth. All this could not be done without fatigue; the insect was indefatigable; his labour was immense; he appeared completely spent; and after having rested his head upon the earth for near an hour, he left the place, and retired under ground.

The next morning, when Mr. Gleditsch visited the body, he found it entirely buried to the depth of two

fingers' breadth, without being in the least altered in its position; so that it resembled a little corpse laid out upon a bier, with a small mount all round for the purpose of covering it. The bird was sunk about half a finger's breadth deeper into the earth before night, and the work continued for nearly two days longer. When the grave was finally completed, the beetles finished the operation by covering the bird with earth.

This gentleman gives another instance of the great industry of this insect. A dead mole and a beetle were enclosed together in the glass vessel, which was covered as before with a fine linen cloth. By seven o'clock in the morning the beetle had drawn the head of the mole into the earth, and formed a tolerably high rampart around it. By four o'clock in the afternoon, the interment of the body was completed. We have no reason to doubt the fact; yet it must appear an astonishing instance of bodily strength and persevering exertion in the little animal, which in so short a time, without any assistance, was able to dig a grave, and bury a body at least thirty times its own size and weight.

Decayed animal substances will always attract these insects, if they are within reach of the smell. A toad, which a friend of Mr. Gleditsch's had fixed upon a stick in order to dry it in the air, allured some of these beetles to the spot. As it was impossible to obtain the toad without bringing it to the ground, they immediately went to work, and

loosened the end of the stick, which was fixed in the earth, so that both fell together, and were then buried by the insects.

This singular occupation, which lasts from the middle of April to the end of October, is a task enjoined these beetles by nature, and the bodies are intended for the nourishment of the future progeny. The eggs which the parent insect deposits in the putrid substance are in process of time hatched into larvæ, which grow to more than an inch in length. These in their turn change into yellowish chrysalides, which after remaining about eighteen days in their oval cells, under ground, become perfect beetles, and begin to dig graves for the benefit of the next generation.

This species is found in different parts of Europe, and in North America; it is likewise found in several parts of our own country.

NUT WEEVIL.

GENERIC CHARACTER.

The snout in this genus is horny and prominent, with two subclavated antennæ growing from its sides.

SPECIFIC CHARACTER.

Curculio Nucum.	C. corpore griseo longitudine rostri. *Linn. Syst. Nat. Gmel.* 1. p. 1676. Of a gray colour with a beak as long as the body. Curculio ovatus griseus rostro filiformi longitudine corporis. *Uddm. Dis.* 24.
Nut Weevil. . .	*Degeer Ins.* 5. p. 205. no. 2. pl. 6. f. 14, 15. *Schæff. Icon* t. 50. f. 4. *Shaw Gen. Zool.* 6. p. 63. pl. 21.

The white maggot which we so frequently find in our hazel nuts and filberts is the larva of this insect, and affords us a curious and familiar instance of the care which Providence takes to conduct even these diminutive creatures through the different stages of their lives, and to provide for them a proper means of subsistence, at a time when they would be incapable of procuring food for themselves.

Naturalists have accounted for the introduction of the maggot into the nut in different ways. Some suppose that the parent weevil deposits its egg on the outside of the nut in its tender state, and that the maggot produced from it eats its way through the shell, without injuring the external coat: others, on the contrary, inform us that the female, when the time approaches to lay her eggs, chooses a good nut, which she pierces with her proboscis, and then deposits an egg in the cavity. We are unable to decide which of these methods is followed by the insect; but the first appears the most probable when we examine the hole, which is larger than the weevil seems capable of making with its beak. The perforation does not in the smallest degree injure the nut, which continues to grow while the little grub within is living on its substance. But the maggot, while he feasts upon the kernel, is not unmindful of the hole through which at a future time he must escape: accordingly he is directed by an unerring instinct to gnaw away the sides from time to time, so that at length they become thin, and afford him a passage to creep through. Before this happens, however, the nut grows to its full size, and falls to the ground, without hurting the little prisoner. About this time, having nearly exhausted all his provision, he prepares to leave his cell, and, after fairly gnawing himself out, begins to burrow into the earth and prepare a convenient retreat for the winter, during

which season he lies dormant, and in the spring casts his skin and becomes a chrysalis. In this form he continues till the month of July, when he emerges from the earth, to enjoy in a winged state the short space of time which nature has allotted for his existence.

There is another species of this genus which is well known to the farmers for its destructive property. THE CORN WEEVIL (*Curculio granarius*, Linn.) is not more than the sixth of an inch in length, and yet it does incredible mischief among the grain. The damage is effected by the insect in the following manner:—The female perforates a grain of wheat, and deposits one or two eggs in the middle of it; then proceeds to another, where she repeats the operation and passes to a third, and so on, till she has laid all her eggs; which occupies her time for several days. After these eggs are hatched, which are not larger than a grain of sand, the larvæ begin to feed upon the ear of corn, and, securely lodged within the husk, destroy all the farinaceous part before they are discovered: even then they do not quit their lodging; but having devoured all its contents, and arrived at their full size, they pass through the chrysalis state in the empty husk, and then burst from their temporary tomb to lay more eggs and multiply their mischief. These destructive little inmates cannot be well detected, as they by no means injure the external appearance of the corn. The best test is to throw some of it

into water, when the grain which has been partly consumed will prove specifically lighter than the rest.

We must not pass over in silence the most brilliant and beautiful species of this, or any other genus of insects. THE DIAMOND BEETLE (*Curculio imperialis*, Linn.) is not to be equalled in splendour by any creature in the world: such indeed is the dazzling brightness of these insects, that in the Brazils, from whence they are brought to us, it is said to be almost impossible to look at them when the sun shines full upon a little swarm as they fly from one place to another. The coal-black colour of the wing-cases is well adapted to improve the lustre of the spots which are placed in parallel rows along the back, and which, when magnified, equal in brilliancy the most precious of all gems. The insect owes this glorious appearance to a number of minute scales, whose polished surfaces reflect the prismatic colours which are so justly the objects of our admiration.

> "Not all the show and mockery of state,
> The little, low, fine follies of the great;
> Not all the wealth which eastern pageants wore,
> What still our idolizing worlds adore,
> Can boast the least inimitable grace,
> Which decks profusive this illustrious race."

Dr. Shaw has given us a good idea of this magnificent beetle, in a magnified representation with which he has enriched his General Zoology.

TIMBER BEETLE.

GENERIC CHARACTER.

Antennæ composed of articulations which gradually diminish in size towards the extremity.
Thorax either spiny or gibbous.
Body oblong.

SPECIFIC CHARACTER.

CERAMBYX VIOLACEUS. C. thorace subpubescente, corpore violaceo, antennis brevibus. *Linn. Syst. Nat. Gmel.* 1. p. 1848.
Thorax somewhat downy, body of a violet colour, antennæ short.
STERNOCORUS VIOLACEUS. *Scop. Ann. Hist. Nat.* 5. p. 97. no. 59.
CANTHARIS NIGRA. Thorace rotundato, elytris cærulescentibus. *Gadd. Diss.* 28.

TIMBER BEETLE. . . *Donovan Brit. Ins.* 2. p. 73. pl. 61. f. 1. *Linn. Trans.* 5. p. 252. pl. 12.

THE Rev. Mr. Kirby has taken some pains to investigate the history of this mischievous little insect; and to his paper, inserted in the Linnæan Transactions, we must acknowledge ourselves indebted for the following information.

It is only after timber has been felled some time that it is liable to be attacked by this beetle; and it seems that spruce fir, of all other kinds, is most to its taste. The female of this species is furnished with a flat retractile tube, which she inserts between the bark and the wood, to the depth of about a quarter of an inch, and there deposits an egg. It appears that she never lays more than one in a place. By stripping off the bark it is easy to trace the whole progress of the larva, from the spot where it was newly hatched, to that where it has attained its full size. At first it proceeds onwards, but in a serpentine direction, filling the space which it leaves behind it with its excrement, resembling saw-dust, and thus stopping all ingress to enemies from without. When it has arrived at its utmost dimensions, it does not confine itself to one direction, but works in a kind of labyrinth, eating backwards and forwards; which gives the wood under the bark a very irregular surface, and considerably increases the width of its path. Its attacks are not confined to the solid timber, but in its progress it eats away an equal portion of the bark. The bed of those paths where it has been at work, exhibits, when closely examined, a curious appearance, occasioned by the erosions of its jaws, which excavate an infinity of little ramified channels. When the larva prepares to assume the chrysalis state, it bores down obliquely into the solid wood, to the depth sometimes of three inches, seldom less

than two. These holes are nearly semicylindrical, expressing exactly the form of the grub. One would wonder, continues Mr. Kirby, how so small and seemingly so weak an animal could have strength to excavate so deep a mine; but when we see its jaws, our wonder ceases: these are large, thick, and solid sections of a cone divided longitudinally, which in the act of mastication apply to each other the whole of their interior plane surface, so that they grind the food of the insect like a pair of millstones. Early in March all the larvæ, except some sickly ones, were observed to have entered the wood in this manner. At the place in the bark opposite to the hole, the perfect insect gnaws its way out of its prison when it makes its appearance, and the beetles continue to come forth from the twentieth of May till about the twentieth of June.

Mr. Kirby observes that this destructive little insect attacks only such timber as has not been stripped of its bark; a circumstance which ought to be known and attended to by all persons who have any concern with this article; for the bark is a temptation not only to the insect in question, but also to many others; and a great deal of the injury which is done to timber would be prevented, if other trees besides the oak were barked as soon as they are felled.

The larvæ of a species of this genus (the *Cerambyx damicornis*, Linn.) are so much admired as a

delicacy in the West Indies, that we are assured negroes are there kept by some persons merely for the purpose of collecting this dainty, which they find buried in particular trees, from whence they scoop them out. However inviting they may be to the taste, there is nothing prepossessing in their appearance; since their soft smooth bodies are three inches and a half long, and as thick as the little finger.

GLOW-WORM.

GENERIC CHARACTER.

The antennæ are filiform.
The elytra, or wing-cases, are weak and flexible.
The thorax flat and semiorbicular; surrounding and concealing the head.
The segments of the abdomen terminate on each side in papillæ or little appendices, which are bent upwards towards the elytra.
The females, in general, want wings.

SPECIFIC CHARACTER.

LAMPYRIS NOCTILUCA. L. oblonga fusca, clypeo cinereo. *Linn. Syst. Nat. Gmel.* 1. p. 1882.
Of an oblong shape and brown colour; the shield cinereous.
Lampyris noctiluca communis. *Degeer Ins.* 4. p. 31. no. 1. t. 1. f. 19, 20.
Cantharis mas coleopterus. *Leche. Nov. Sp.* 23. no. 47.
GLOW-WORM. . . . *Geoff. Ins.* 1. pl. 2. f. 7. *Shaw Gen. Zool.* 6. p. 78. pl. 28.

THE great difference in appearance between the male and female glow-worm would induce many

to suppose them distinct species. No two insects can be more opposite. The male, a small cylindrical beetle, provided with wings and wing-cases, can rise into the air at pleasure; the female, a solitary creeping worm, denied the power of flight, must for ever remain upon the earth. It is she, however, to whom we are indebted for the beautiful glowing spot of light which shines with so much splendour in the calm evenings of our summer months. When the weather is favourable many of these little lamps may be seen scattered about our meadows, or arranged along the bottoms of our hedges. The insect from whence this light proceeds is about three quarters of an inch in length, and has a body divided into ten joints; the three last of which are of a pale sulphur colour: a very small head projects from an oval breast-plate, and three slender legs are placed on each side the body. This general description will enable us to distinguish the insect in the day-time; by night the object can never be mistaken.

It is generally acknowledged that the light emitted from the glow-worm's tail is phosphoric, and that it is placed there in order to attract the attention of the male. Without some such compensation, how hard would be her lot! The dissimilarity between the two sexes is very great; their manners, perhaps, totally different: the male, a little, volatile, winged insect, might never be led

to his sedentary mate, if it were not for the light of her radiant torch.

> " The chilling night-dews fall ; away, retire ;
> For see, the glow-worm lights her am'rous fire !
> Thus, ere night's veil had half obscur'd the sky,
> Th' impatient damsel hung her lamp on high :
> True to the signal, by love's meteor led,
> Leander hasten'd to his Hero's bed."

PHOSPHORIC BEETLE.

GENERIC CHARACTER.

Antennæ setaceous.

Body oblong, and provided with an elastic spine which projects from the under side of the thorax.

SPECIFIC CHARACTER.

ELATER NOCTILUCUS. E. thoracis lateribus macula flava glabra. *Linn. Syst. Nat. Gmel.* 1. 1902.
Thorax marked on each side by a smooth yellow spot.
ELATER FUSCUS, thoracis lateribus macula flava glabra convexa nitida. *Degeer Ins.* 4. p. 160. no. 2. pl. 18. f. 1.
Elater major fuscus phosphoricus. *Brown Jam.* 432. t. 44. f. 10.

PHOSPHORIC BEETLE. *Shaw Gen. Zool.* 6. p. 84.

THIS luminous insect, which is about an inch and a half in length, is an inhabitant of South America, where it diffuses so strong a light, during the night, that it is said a person may easily see to read by it, if held between the fingers and moved along the lines. Eight or ten of them inclosed in a clear glass phial are supposed to give as much light as a

common candle. This brilliant phosphoric emanation issues from the two smooth yellow spots noticed in the specific character; and we are told that the inhabitants of Hispaniola, &c., before the arrival of the Spaniards, made use of no other light than what was produced by these insects. It has even been said, though with no great degree of probability, that when Sir Thomas Cavendish and Sir Robert Dudley, son to the Earl of Leicester, first landed in the West Indies, they were surprised by the number of lights which, in the evening, they saw moving about in the woods; and, supposing that the Spaniards were advancing towards them, they became alarmed and immediately retreated to their ships.

EXPLODING BEETLE.

GENERIC CHARACTER.

Antennæ setaceous.

Thorax margined, and shaped like a heart with the point cut off.

Abdomen oval, covered by margined wing-cases.

SPECIFIC CHARACTER.

CARABUS CREPITANS. C. thorace capite pedibusque ferrugineis, elytris nigris. *Linn. Syst. Nat. Gmel.* 1. p. 1971.

The head, thorax, and feet, of a rusty brown colour; wing-cases black.

Carabus alatus ferrugineus, &c. *Degeer Ins.* 4. p. 103. no. 22. pl. 3. f. 18.

EXPLODING BEETLE. *Schæff. Icon.* pl. 11. f. 13. *Voet. Coleopt.* pl. 36. f. 26.

THIS insect possesses the very singular faculty of discharging a disagreeable vapour accompanied by a smart explosion, whenever it is provoked. It is enabled to repeat its noise several times in succession, and may at any time be made to do so by scratching its back with a needle. It appears that the blueish smoke which issues from behind the

insect on these occasions, is contained in a bag placed near its posterior extremity, and the vapour is said to be of such a pungent nature, that, if it happen to be discharged into the eyes, it causes as painful a sensation as if brandy was thrown into them. Rolander, who first made these observations, by irritating one of the insects, caused it to give twenty explosions successively.

It conceals itself among stones, and moves by a sort of jump. The fetid discharge which it emits is given it as a means of defence against its enemies, for it has several, and among others, one of its own tribe of a much larger size. When pursued by this formidable adversary, who advances with open jaws to seize him, the exploding beetle discharges his artillery, and envelopes his enemy in the acrid vapour; this for a moment puts a stop to the pursuit, and our beetle attempts in the confusion to hide himself in some hole or crevice; but if he should not succeed, his destruction is inevitable; the enemy returns to the attack, and, seizing him by the neck, tears off his head.

This insect is found in several parts of Europe, and sometimes in England.

OIL BEETLE.

GENERIC CHARACTER.

Antennæ moniliform, or resembling a string of beads, with the last articulation of an oblong oval form.
Thorax roundish.
Elytra soft and flexible.
Head inflected and gibbous.

SPECIFIC CHARACTER.

MELOE PROSCARABÆUS.	M. corpore violaceo. *Linn. Syst. Nat. Gmel.* 1. 2017.
	Body of a violet colour.
	CANTHARIS PROSCARABÆUS. *Degeer Ins.* 5. p. 31. t. 1. f. 1.
OIL BEETLE. . . .	*Schæff. Icon.* pl. 3. f. 5. *Shaw Gen. Zool.* 6. p. 104. pl. 37.

THIS beetle derives its name from a property which it has of exuding several small drops of oil from the joints of its legs, and from some other parts of the body, on being handled. The account which Dr. Shaw has given of this insect is nearly as follows: It is frequently found near an inch and a half in length; is of a violet-black colour, especially on the antennæ and limbs: in the female the wing-sheaths are re-

markably short, and cover but little more than a third of the body. Oil beetles are common in the advanced state of spring in fields and pastures, where they may be seen creeping slowly along, and dragging after them a body which appears to be so loaded and distended with eggs as to cause the insects to move with difficulty. The eggs, which are very small, and of an orange colour, are deposited by the female in a large heap or mass beneath the surface of the ground: from these are hatched the larvæ, which at their first appearance scarcely measure a line in length, and are of an ochre yellow, with black eyes: they are furnished with short antennæ, six legs of moderate length, and a long, jointed, tapering body, terminated by two forked filaments or processes. These larvæ are found to live by attaching themselves to other insects and sucking their juices. They have been seen to fasten themselves strongly to common flies, &c., a practice so extraordinary as to have caused considerable doubt whether they could possibly have been the real larvæ of the meloe proscarabæus. It has been, however, completely proved by Degeer that they immediately fasten themselves to any insect, whether living or dead, that is placed near them. The oil which is exuded from the body of this beetle is of a deep yellow colour, and of a very peculiar and penetrating smell. It has been highly celebrated for its supposed efficacy in rheumatic pains, &c., and was occasionally used as an embrocation on the parts affected.

Another species of this genus, (the *Meloe vesicatorius* Linn.,) is well known for its activity in raising a blister. This is the common SPANISH FLY of the shops, and is a native of the warmer parts of Europe, as the South of France, Italy, Spain, and Portugal. This species is usually about an inch long and of a most brilliant colour, being of a rich gilded grass green mixed with azure. They are found on different trees, especially the ash, which they are said to be extremely fond of, insomuch that they will sometimes destroy all the leaves. It appears that they are frequently seen flying together like swarms of bees, and that they emit a very disagreeable smell which taints the air to a considerable distance around them. This offensive smell is a guide for those who are employed to catch them, for it serves to conduct the persons to the desired spot where the insects are settled. When caught, they are tied in a piece of soft linen cloth, and killed with the vapours of hot vinegar; after which they are dried in the sun and kept in boxes: they are then so light that fifty of them will hardly weigh a drachm.

EARWIG.

GENERIC CHARACTER.

Antennæ setaceous.
Elytra much shorter than the abdomen.
Extremity of the abdomen armed with a kind of forceps.

SPECIFIC CHARACTER.

FORFICULA AURICULARIA.	F. elytris apice albis, antennis quatuordecim articulatis. *Linn. Syst. Nat. Gmel.* 1. p. 2038.
	Apex of the wing-cases white; antennæ divided into fourteen articulations.
	FORFICULA MAJOR. *Degeer Ins.* 3. p. 545. no. 1. pl. 25. f. 16.
	VERMIS AURICULARIUS. *Frisch. Ins.* 8. p. 31. pl. 15. f. 1, 2.
COMMON EARWIG. . .	*Schæff. Icon.* pl. 144. f. 3, 4. *Shaw Gen. Zool.* 6. p. 110. pl. 40.

THIS insect is very generally known, and too commonly dreaded, from a false notion that it will enter the cavity of a person's ear, and, by piercing the drum, deprive him of hearing, and even cause his death by the intolerable pain which it produces. This idea might have originated in the great pro-

pensity which the earwig has to creep into holes and cavities whenever it has an opportunity. But it is accused unjustly of doing harm, since it has not the power to do it, notwithstanding the formidable appearance of its forked tail.

A remarkable part of the structure of this insect is its elegant wings, which are so completely shut up under the wing-cases and so rarely expanded in the day-time, that the generality of observers, who are not conversant in natural history, suppose them to be entirely wanting. The wings are very large in proportion to the animal, and it is wonderful to observe the very small space they take up before they are protruded. Great contrivance is manifested in the folding of them: they are first closed lengthways like a fan, and afterwards refolded across in two different places, so as to lie in the least possible compass, and in the best manner for immediate expansion.

The earwig, like most other insects, is hatched from the egg, and the female when she deposits her burthen generally chooses a moist and shaded situation for her purpose. This is frequently under a stone, where the little white and oval eggs remain till the young larvæ burst from the shells, formed in every respect like the parent, except that the forceps at the tail are not at first turned inwards. It seems that the parent insect is really attached to her young; and, singular as it may appear among this tribe of animals, she fosters them with the greatest care. The indefatigable M. Degeer, who

remarked this peculiarity, informs us that at the beginning of June, he found under a stone a female earwig, attended by a little progeny which evidently appeared to be her own. They continued near her, and frequently ran under her belly, where she brooded over them as a hen does over her chickens. M. de Geer conveyed them all into a box of fresh earth, and observes that they did not enter the earth, but thrust themselves under the belly and between the legs of the mother, who frequently permitted them to remain there for an hour at a time. Ripe apple seemed to be a favourite food with this little family; and a piece of it put into the box was immediately attacked by all of them. We have already observed, that when the earwigs are first hatched they strongly resemble the parent; nevertheless M. de Geer remarks, that when the young earwigs changed their skins (which happened in the course of a week after he noticed them), though the alteration in their figure was hardly perceptible, yet it appeared to bring them nearer to the perfect insect.

This gentleman has given us another instance of the attachment of this insect to her brood, particularly during incubation. About the beginning of April he found a female under some stones sitting over a heap of eggs with the greatest care. He took the whole of them up together, and, having placed them in a box partly filled with fresh earth, scattered the eggs up and down in it. This put the parent to confusion: however, she soon removed

them one after the other, carrying them between her jaws, and in a few days he observed that she had brought them all to one spot upon the surface of the earth, where she continued to sit, without quitting the heap a moment, and seemed regardless of every thing but the important purpose of hatching her eggs. The young were produced about the fourteenth of May, and he kept them in the box with their mother till they had changed their skins more than once. He fed them with small bits of apple, and saw them grow every day. The mother died, and her progeny devoured nearly the whole of her body. This unnatural propensity appeared to prevail throughout the family; for, if one of the little ones died, it was immediately attacked by the rest, and shared the same fate. M. de Geer, however, thinks they were driven to this necessity by his neglect, since he had not supplied them regularly with food.

These insects are very destructive to our fruits and vegetables, and numbers of them may be found busily employed upon our esculent plants in the night-time. The common practice of putting the bowl of a tobacco-pipe, or the claws of a lobster, upon the top of an upright stick, will always attract them, as they constantly shun the light, and are ready to seek any recess during the day where they may be sheltered from its rays.

HEMIPTEROUS INSECTS.

GREAT COCKROACH.

GENERIC CHARACTER.

Antennæ setaceous.
Elytra and wings extended, smooth and semi-coriaceous, or of a substance resembling vellum.
Thorax rather flat, of an orbicular shape, and margined.
Abdomen terminated by two little appendices like horns.

SPECIFIC CHARACTER.

BLATTA GIGANTEA. B. livida, thoracis clypeo macula quadrata fusca. *Linn. Syst. Nat. Gmel.* 1. p. 2041.
Thorax and shield marked with a brown square spot.

GREAT COCKROACH. *Seb. Mus.* 3. pl. 77. f. 1, 2, and 4. pl. 85. f. 17, 18. *Drury Ins.* 2. pl. 36. f. 2. *Shaw Gen. Zool.* 6. p. 113. pl. 41.

THIS is the largest of all the cockroaches, and a very noisome insect. They swarm in the West Indies, where, according to the account we find of them in Drury's third volume of Exotic Insects, they fly out in the evenings and commit monstrous

depredations: every thing that comes in their way is damaged by them; all sorts of clothing, and all kinds of victuals, drest and undrest, are indiscriminately plundered or spoiled: every thing made of leather; books, paper, and various other articles, are damaged by these insects, as they frequently deposit a drop of their excrement where they settle, and thus injure what they cannot destroy. They often fly into persons' faces or bosoms; and their legs being armed with sharp spines, the pricking excites a sudden horror not easily described. It appears that if one of them falls into some ink, of which they are very fond, it soon turns most offensively putrid, and the ink becomes unfit for use on account of the abominable smell.

"In old houses," says the account we have already noticed, "they swarm by myriads, making every part filthy beyond description wherever they harbour, which in the day-time is in dark corners, behind all sorts of clothes, in trunks, boxes, and, in short, every place where they can lie concealed. In old timber and deal houses, when the family is retired at night to sleep, this insect, among other disagreeable properties, has the power of making a noise which very much resembles a pretty smart knocking with the knuckle upon the wainscoting. The *Blatta gigantea* of Linnæus, in the West Indies, is therefore frequently known by the name of the drummer. Three or four of these noisy creatures will sometimes be impelled to answer one another, and cause such a drumming noise that none but

those who are very good sleepers can rest for them. What is most disagreeable, those who have not gauze curtains are sometimes attacked by them in their sleep; the sick and dying have their extremities attacked, and the ends of the toes and fingers of the dead are frequently stripped both of the skin and flesh."

Our common black beetle is of this genus, and was originally imported from the East. It is the *Blatta orientalis* of Linnæus, and is well known in this metropolis.

CAMEL CRICKET.

Designed by W. Daniell.

Published by Messrs. Cadell & Davies, London March 1 1807.

CAMEL CRICKET.

GENERIC CHARACTER.

Head unsteady, armed with jaws, and furnished with palpi or feelers.

Antennæ setaceous.

Wings membranaceous and wrapped round the body.

Two fore legs compressed; armed on the under side with teeth like a saw, and terminated by a single nail or crotchet.

Thorax narrow, and extended to a considerable length.

SPECIFIC CHARACTER.

MANTIS ORATORIA. M. thorace lævi, elytris viridibus immaculatis. *Linn. Syst. Nat. Gmel.* 1. p. 2050. Thorax smooth; wing-cases green and without spots.

MANTIS. *Geoff. Ins.* 1. p. 399. no. 1. pl. 8. f. 4.

CAMEL CRICKET. *Seb. Mus.* 4. pl. 67. f. 9, 10. *Shaw Gen. Zool.* 6. p. 118. pl. 42.

THESE singular insects are known only in the warmer parts of the world, where they have become celebrated for their peculiar manners and quarrelsome disposition. When at rest, they are

generally seen in a sitting posture with the two fore legs close together, and thus appear as if they were praying: this attitude, so well calculated to impose upon the eastern devotees, has gained them great credit, and they are therefore regarded as sacred animals, that ought not to be injured. We are gravely told, by the translator of Mouffet, that even if a child has lost its way and inquires of the mantis, the insect will point out the right path with its paw. This intelligence, however, is of a piece with his sanctity, and both are equally devoid of foundation; for this most devout of insects is very apt to neglect his spiritual for his temporal concerns, and does not scruple to prey upon any of his fellow-creatures that he can manage. Dr. Smith was informed of a gentleman who enclosed a male and female together in a glass vessel, and found that in a short time the female (which is the largest) attacked her companion and devoured him entirely, beginning at his head.

They are so far from being peaceably inclined, that two of them cannot be brought together without a battle being the consequence; and in these rencontres they pay no respect to age or sex. Roesel, who kept some of these fighting creatures, observed that the moment they were in sight of each other they tossed up their heads, and brandishing their fore legs seemed to bid defiance to their adversaries. The battle was begun by the boldest throwing open his wings, and rushing on the other, which was sometimes immediately torn

in pieces. In these mutual conflicts their manœuvres, according to Roesel, very much resemble a battle between two Hussars; for they use their long fore-legs like sabres, and sometimes one of them will cleave the other through at a single stroke, or strike off his head from his body. A most revengeful spirit seems to actuate these little creatures; for the body of the vanquished is always devoured by the conqueror.

This quarrelsome disposition in the mantis has not escaped the Chinese, who are said to train them up like game-cocks, and make them fight for their amusement. Mr. Barrow has the following passage in his account of China, which alludes to this insect. "They have even extended their inquiries after fighting animals into the insect tribe, and have discovered a species of gryllus, or locust, that will attack each other with such ferocity as seldom to quit their hold without bringing away at the same time a limb of their antagonist. These little creatures are fed and kept apart in bamboo-cages; and the custom of making them devour each other is so common, that, during the summer months, scarcely a boy is to be seen without his cage of grasshoppers."

It appears that these insects are barbarians from their birth: they are no sooner hatched than their disposition begins to show itself, and the little savages will even neglect their food to prey upon each other. Roesel, who tried to raise a number

of them together from the egg state, found it impossible; for they had hardly come to life before they began to brandish their weapons and commence an attack. Notwithstanding their natural ferocity, they became complete cowards when some ants were put into the glass vessel in which they were confined, and attempted to escape in every direction. House-flies, however, they seized with avidity, and tore them in pieces with their fore-claws. But nothing could long divert them from their savage habits; they soon neglected the flies, and wantonly destroyed each other. As a last resource he separated them into small parties, and confined them in different glasses: but here the same thing occurred; the combatants never rested till the strongest in each community had killed all his companions.

There is a species of this genus of the most singular appearance; The DRY LEAF MANTIS (*mantis siccifolia*, Linn. *) is a remarkable instance of the provision of nature for the security of the insect against the attacks of its enemies. This harmless little creature is denied the offensive claws with the edge of which the camel cricket so readily chops off his adversary's head; but it can boast an advantage in its figure which more than compensates for the want of weapons. Its form is an exact representation of a leaf that has fallen from the tree

* The *phasma siccifolium* of Shaw.

and become partly withered. This resemblance is so strong that while the animal continues at rest, it has nothing to fear from those common enemies the birds, who, deceived by the appearance of its withered foliage, will leave it unmolested. This mantis is a native of India, from whence we receive our specimens, which are generally of a yellowish brown colour.

LOCUST.

GENERIC CHARACTER.

Head inflected, armed with jaws and furnished with palpi.
Antennæ filiform.
Wings four; declined, and wrapped round the sides of the body.
Two claws on each foot; hind-feet formed for leaping.

SPECIFIC CHARACTER.

GRYLLUS MIGRATORIUS.	G. thorace subcarinato: segmento unico capite obtuso, maxillis atris. *Linn. Syst. Nat. Gmel.* 1. p. 2075.
	Thorax subcarinated; a single obtuse segment on the head: jaws black.
	GRYLLUS MIGRATORIUS. *Frisch. Ins.* 9. pl. 1. f. 8.
	ACRYDIUM MIGRATORIUM. *Degeer Ins.* 3. p. 466. no. 1. pl. 23. f. 1.
LOCUST.	*Seb. Mus.* 4. pl. 65. f. 21. *Shaw Gen. Zool.* 6. p. 128. pl. 48.

THE very name of this insect conveys a sensation of horror and disgust, which is naturally excited in our minds by the recollection of the dreadful scourge which it has occasionally been to mankind.

The locusts commit the most terrible ravages in the warmer parts of the globe, where they descend in legions and devour every blade of grass, and strip every tree of its leaves; so that a whole province, which but a few days before boasted its fertility, is presently reduced to a desert. The surface of the earth appears entirely covered with them to a great distance, and the noise they make while feeding may be distinctly heard. Their incredible numbers are formidable even in death; for an event which on other accounts is so desirable, is in those tropical countries to be dreaded; since the putrefaction arising from their bodies has been considered as a cause of pestilence.

Flights of locusts have occasionally appeared in different parts of Europe, and a few swarms in the year 1693 visited some parts of Wales. Germany in the year 1732 suffered considerably by their ravages, and in the years 1747 and 1748, they paid a most destructive visit to several parts of the Continent. Their proceedings in these two years are regularly detailed in the forty-sixth volume of the Philosophical Transactions, from whence we have extracted the following account.

The first swarms appeared in Transylvania, in August 1747; these were succeeded by others, which were so surprisingly numerous, that they were full four hours in passing over a place called the Red Tower, and they flew so close that they made a sort of noise in the air by the beating of their wings against one another. The width of the

swarm was several hundred fathoms, and its density so great that it hid the sun, and darkened the sky to that degree that when it was but a little way from the ground the people could hardly distinguish each other at the distance of twenty paces. Being at length tired with their flight, one part of them alighted on some unripe corn, while another took possession of a wood, and having miserably wasted the produce of the land, they continued their journey as if a signal had actually been given for a march. The guards stationed at the Red Tower attempted to stop their flight into Transylvania by firing at them: and where the balls and shot swept through the swarm, they gave way; but having filled up their ranks in a moment, they proceeded on their journey. In the month of September some troops of them were thrown to the ground by heavy rains and inclement weather. These were miserably soaked, and were seen creeping along in quest of holes in the earth, dung, and straw; where being sheltered from the wet they laid a great number of eggs which stuck together, and were longer and smaller than what is commonly called an ant's egg: vast numbers of these eggs were afterwards turned up and crushed by the plough.

In the spring of 1748, little blackish worms were seen lying in the fields and among the bushes, sticking together and collected in clusters, not unlike the hillocks of moles or ants. It appears that the inhabitants, not knowing what they were, dis-

regarded them, till in the month of May they were covered by the shooting of the corn. These proved to be the same pests under a different form; for in the month of June, when the spring corn had grown to a tolerable height, they began to spread over the fields and destroy the vegetation. It was now too late to extirpate them; they had dispersed themselves in every direction, and could by no means be destroyed. At this time they resembled common grasshoppers, and were generally about a finger's length; but towards the end of June they cast their skin and plainly discovered their wings, which they gradually unfolded with their hind feet; and as soon as any of them found themselves able to fly they left the ground, and soaring round the others enticed them to follow. Thus their numbers daily increasing, they took circular flights of twenty or thirty yards, until they were joined by the rest; when they miserably laid waste their native fields, and then proceeded elsewhere. Whereever these swarms happened to pitch, they spared no sort of vegetable; every green thing was totally destroyed, and nothing could present a more dismal sight than the lands which gave them birth: they were literally stripped of every thing that bore the least appearance of a vegetable, and the ground was left perfectly bare.

Barbary was invaded by a host of these pestiferous insects in the year 1724: at that time Dr. Shaw was travelling in the country, and saw the dreadful effects of their visitation. They made

their appearance about the end of March, and came in with a southerly wind. Early in April their numbers increased prodigiously; and in the heat of the day large swarms appeared, which, according to Shaw, were so dense as to darken the sun. In the following month they retired to deposit their eggs, and in June the young brood was hatched, and was seen advancing in bodies of some hundred yards square. Large trenches were formed by the inhabitants in different parts of the fields, and filled with water, to stop their march, and large quantities of combustible materials were collected and set on fire for the same purpose; but all was in vain, their progress was not to be stopped; they advanced notwithstanding every obstacle, climbing over every barrier, and devouring every vegetable that came in their way. After having committed the greatest devastations, and having passed through the different states of their existence, this dreadful scourge left the country, and probably perished in the sea.

During Mr. Barrow's travels into the interior of Africa, he had more than one opportunity of observing these voracious animals; and what he has said respecting them is delivered in his usual clear and satisfactory manner.

"As we advanced to the northward," says this intelligent traveller, "a curious but most deplorable spectacle presented itself to our observation. It was a troop of locusts resting upon the ground. The space they covered was about one square mile in

extent, and so completely that the surface appeared to the eye, at a little distance, to have been burned and strewed over with brown ashes. Not a shrub nor blade of grass was visible. The waggons passed directly through them, before which they rose up in a cloud that darkened the air on each side. Desirous of seeing the whole troop on the wing, the Hottentots ran amongst them, and the horses were made to gallop through them, but without success; none but such as were immediately under the feet of the men and horses rose up. In all other parts they remained firm on the ground. The peasantry pretend that they are not to be driven away unless the signal for departure should be given from their commander in chief, one of which is supposed to accompany every troop."

Wherever these noxious insects made their appearance the crops were destroyed, and not a single field of corn remained unconsumed by them. During the year Mr. Barrow was in Africa, a whole district was so completely laid waste as not to produce a single bushel of grain. But the inhabitants, accustomed to this calamity, bear the evil with great patience, and console themselves for the loss of their corn by killing a double quantity of mutton.

As Mr. Barrow continued his journey, he met with innumerable multitudes of the incomplete insect, or larva of the locusts. According to this gentleman's account, no adequate idea could possibly be conceived of their numbers without having seen them. " For the space of ten miles on each

side of the Sea-cow river, and eighty or ninety miles in length, an area of sixteen or eighteen hundred square miles, the whole surface of the ground might literally be said to be covered with them. The water of the river was scarcely visible on account of the dead carcases that floated on the surface, which had perished in the attempt to devour the reeds that were growing in the water. They had completely destroyed every herb and every blade of grass; and had it not been for the insulated reeds, on which our cattle entirely subsisted while we skirted the banks of the river, our journey must have been discontinued, at least in the line that had been proposed, for want of food for our horses and cattle. The larvæ, as generally is the case in this class of insects, are much more voracious than the perfect animal; nothing is rejected by them that belongs to the vegetable part of the creation. They swarmed in thousands into our tent to devour the crumbs of bread that fell on the ground, and seized with avidity on a mutton bone. They are not, however, without a choice in their food. When they attack a field of corn just stricken into the ear, they first mount to the summit, and pick out every grain, before they touch the leaves and stem. In such a state it is lamentable to see the ruins of a fine field of corn. The insect seems constantly to be in motion, and to have some object in view. When on a march, during the day it is utterly impossible to turn the direction of a troop, which is generally the same as that

of the wind. The traces of their route over the country remain for many weeks after they have passed it, the surface appearing as if swept by a broom, or as if a harrow had been drawn over it. Towards the setting of the sun the march is discontinued, when the troop divides into separate companies, which surround the small shrubs, or tufts of grass, or ant-hills, and in such thick clusters that they appear like so many swarms of bees; and in this manner they rest till day-light. It is at such times only, when they are thus formed into groups, that the farmers have any chance of destroying them, which they sometimes effect by driving among them a flock of two or three thousand sheep, by whose restlessness they are trampled to death.

" Luckily the visits of this gregarious insect are but periodical, otherwise the whole country must inevitably be deserted, as wherever they appear they rest, as the prophet in Holy Writ hath said, ' upon all thorns, and upon all bushes.' Even at this time the cattle in many parts of Sneuwberg are starving for want of food. The present year * is the third of their continuance, and their increase has far exceeded that of a geometrical progression whose ratio is a million. For ten years preceding their present visit, the colony had been entirely free from them. Their last departure was rather singular. All the full-grown insects were driven

* 1797.

into the sea by a tempestuous north-west wind, and were afterwards cast upon the beach, where, it is said, they formed a bank of three or four feet high, which extended from the mouth of the Bosjesmans river, to that of the Beeka, a distance of near fifty English miles; and it is asserted, that when this mass became putrid, and the wind was at south-east, the stench was sensibly felt in several parts of Sneuwberg. Fortunately they were driven thus to sea before they had deposited their eggs in the ground. The larvæ, at the same time, were emigrating to the northward. The column of these imperfect insects passed the houses of two of our party, who assured me that it continued moving forwards without any interruption, except by night, for more than a month. The *gryllivori* * in myriads were close at their heels, and departed along with them, devouring them as they proceeded; since which, till the present year, not one of this species of bird was to be found in the country."

Swarms of locusts have ravaged the different parts of the world from the earliest time to the present day; and the æras in which they have appeared, have been recorded by several authors; particularly by Aldrovandus, in whose works the times of their appearance have been carefully noticed.

The larger species of locusts are used as food by the inhabitants of the East, and are publicly sold in the markets. Although the edible sort are six times

* Locust-eating thrush.

the size of the common species, they afford but a small share of nourishment, especially the males, who want the magazine of eggs which contribute to make the females more nutritious. This kind of food has been eaten in those countries where the insects are plentiful, from the earliest period to the present day, and they either eat them fresh, broiled on the coals, or pickle them for keeping, in which last state they are generally brought to market. It has been supposed by some commentators, that the passage in the Holy Scriptures, in which St. John the Baptist is said to have fed on locusts and wild honey, is not properly translated, and that the word which we understand to mean locusts should be rendered the young shoots of vegetables. But this interpretation is totally unnecessary, since we have seen that these insects are really used as food in the eastern parts of the world at the present time. Hasselquist remarks, that they who deny these insects to have been the food of this holy man, would soon be convinced of the contrary if they would travel through Egypt, Arabia, or Syria, and take a meal with the Arabs. Roasted locusts are eaten by these people, at the proper season, whenever they can procure them.

MOLE CRICKET.

SPECIFIC CHARACTER.

GRYLLUS GRYLLOTALPA. G. alis caudatis elytro longioribus, pedibus anterioribus palmatis tomentosis. *Linn. Syst. Nat. Gmel.* 1. p. 2059.

Wings much longer than the wing-cases, and reaching beyond the tail: fore-feet palmated and downy.

Gryllus supra fuscus, subtus ferrugineo-flavus, &c. *Degeer Ins.* 3. p. 517. no. 2.

MOLE CRICKET. . . . *Catesb. Carol.* 1. pl. 8. *Roes. Ins.* 2. pl. 14, 15. *Schæff. Icon.* p. 37. f. 1. *Shaw Gen. Zool.* 6. p. 140. pl. 50.

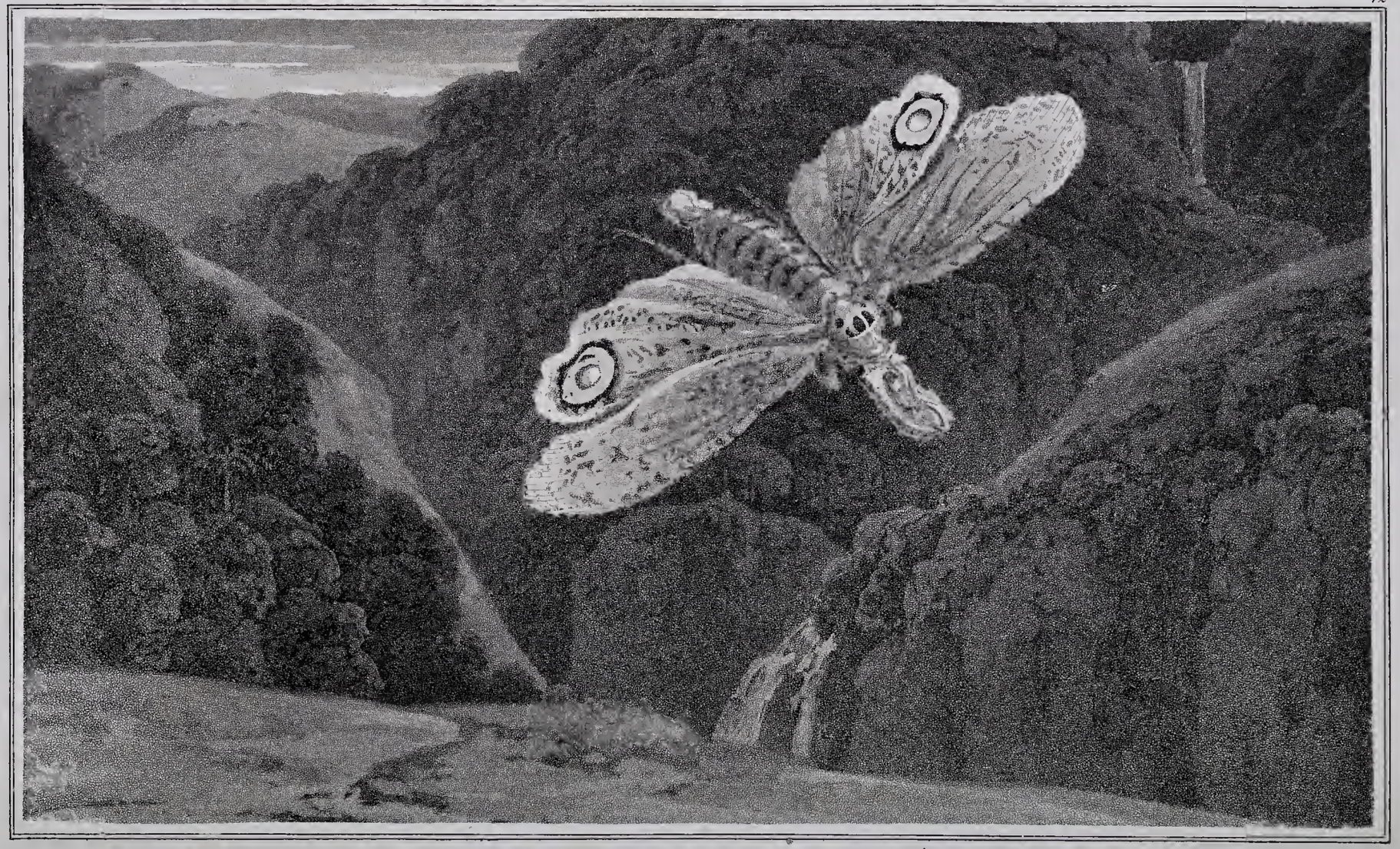
THE singular structure of the fore-feet of this insect, which are very broad, and divided into several sharp segments like claws, have obtained it the name of mole cricket: the fore-feet not only resemble those of the mole, but are constructed for the same purpose; namely, to assist the insect in burrowing under ground. The general form of this cricket is unpleasant: its length exceeds two inches; its colour is a dusky brown, and its body is terminated by two long sharp-pointed processes.

In the day-time the mole cricket buries itself under the surface of the earth, and only ventures from its retreat during the night, when it creeps about and occasionally makes a chirping noise. The nest which the female prepares for her eggs is of an oval form, made of clammy earth, and large enough to hold a full-sized walnut. This is generally situated about three inches under ground, and is perfectly smooth within, where the eggs, to the number of a hundred and fifty or two hundred, are deposited. Mr. White, of Selborne, saw one of these repositories laid open by a gardener, who, mowing by the side of a canal, chanced to pare off a large piece of turf and expose this curious instance of domestic œconomy. He observed several caverns and winding passages leading to a kind of chamber, neatly smoothed, and about the size of a moderate snuff-box. Within this secret nursery were deposited near a hundred eggs, of a dirty yellow colour, and enveloped in a tough skin full of a viscous substance. The eggs were but a little way under the surface, within the influence of the sun, and just under a little heap of fresh mould, like that which is raised by ants. The eggs of the mole cricket are nearly of a round shape, and about the size of seed pearl. They are usually deposited in May, and hatched in July or August.

The female insect is said to pay great attention to her nursery, and to defend it from the weather by sinking it deeper or raising it nearer the surface, according as the ground is moist or dry. She is

likewise careful to prevent her nest from being plundered by the black ground beetles, who are supposed to be fond of the eggs: to check the ardour of these invaders, we are told the female is often posted as a sentinel near the nest; and when the black enemy prepares to seize his prey, the watchful insect catches him behind and instantly bites him in two.

The mole cricket feeds entirely on vegetables, and is therefore a great enemy to gardeners: it not only devours the roots of the common esculent plants, but makes great havoc in hot-beds, where many choice productions have been cut off by this insect.



LANTERN FLY.

Designed by W. Daniell.

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LANTERN FLY.

GENERIC CHARACTER.

Head extended on the fore part, where it forms an inflated cavity.

Antennæ seated below the eyes, and having two articulations, of which the exterior are globose.

Snout inflected.

Feet formed for walking.

SPECIFIC CHARACTER.

FULGORA LANTERNARIA.	F. fronte rostrata recta, alis lividis: posterioribus ocellatis. *Linn. Syst. Nat. Gmel.* 1. p. 2089. A straight beak in front; wings livid; a large eye-shaped spot in each of the lower wings. CUCUJUS PERUVIANUS. *Grew Mus.* 158. t. 13.
LANTERN FLY. . . .	*Merian Surin.* pl. 49. *Reaumur Ins.* 5. pl. 20. f. 6, 7. *Shaw Gen. Zool.* 6. 144. pl. 52.

THESE flies greatly alarmed Madam Merian when she first received a parcel of them from some Indians who brought them to her before she was aware of their phosphoric quality, and she gives

the following account of her surprise when first she saw their flashing light:

"The Indians once brought me, before I knew that they shone by night, a number of these lantern flies, which I shut up in a large wooden box. In the night they made such a noise that I awoke in a fright, and ordered a light to be brought; not knowing from whence the noise proceeded. As soon as we found that it came from the box, we opened it; but were still much more alarmed, and let it fall to the ground in a fright, at seeing a flame of fire come out of it; and as many animals as came out, so many flames of fire appeared. When we found this to be the case, we recovered from our fright, and again collected the insects, highly admiring their splendid appearance."

This beautiful insect inhabits Surinam and many other parts of South America, where its vivid light is serviceable to travellers; three or four of them, tied to the end of a stick, being frequently used by night instead of a torch. It is from the large hood or lantern, which projects from the body of this fly, that the radiant light is emitted, and we may judge of its splendour when we are assured by Madam Merian that one of them is sufficient to read a common newspaper by.

The lantern fly is of large size, sometimes measuring nearly four inches in length and five inches across the wings, when they are expanded. The most remarkable part about it is the head, which

is, as it were, inflated to a large disproportioned size, and appears more like an appendage, than a natural portion of the animal's body; it is in this part, as we have already observed, that the phosphorus is contained, and from hence those luminous flashes are emitted which have contributed to make the insect so justly celebrated.

CICADA.

GENERIC CHARACTER.

Rostrum, or snout, bent inwards under the breast.
Antennæ setaceous.
Wings four, membranaceous, declining along the sides of the body.
Feet in most species formed for leaping.

SPECIFIC CHARACTER.

CICADA SPUMARIA. C. fusca, elytris maculis binis albis lateralibus: fascia duplici interrupta albida. *Linn. Syst. Nat. Gmel.* 1. p. 2102.

Of a brown colour, with two lateral white spots, or rather two irregular whitish bands on the upper wings.

Cicada fascia duplici albida interrupta transversa. *Geoff. Ins.* 1. p. 415. no. 2.

Cicada spumaria graminis. *Degeer Ins.* 3. p. 163. no. 1. pl. 11. f. 1. 21.

CUCKOO SPIT. . . *Merian Ins.* 77. pl. 51. *Schæff. Elem.* pl. 42. *Shaw Gen. Zool.* 6. p. 153.

THE little patches of foam which we so often observe upon rose-trees and on blades of grass, &c. are the production of this insect in the larva state. This froth, which has obtained the name of cuckoo spit, contains the little green cicada; and it is said

the insect sucks the juices of the plant where it resides, and afterwards ejects them from its vent in the form of minute bubbles, till it has completely covered itself, and has thus secured a cool summer retreat. This operation may be readily observed by removing the froth from the little animal, which will soon emit fresh moisture and again cover itself from our sight. The small sucker with which it extracts the moisture from the plant may be observed if the insect is carefully examined, and will generally be found lying close to the under part of the thorax.

This delicate little creature remains enveloped in foam till it has undergone its different transformations and become a perfect insect. After it has grown to its full size and passed the chrysalis state (which so strongly resembles that of the larva as not to be distinguished), the froth becomes viscid, and no longer invests the insect as before, but fixes it to the plant, where it remains till the final change is effected, and the perfect cicada emerges from its sheath. If the insect is watched during this transformation, it will be observed first to put out its head, and afterwards by dgrees its body: a small protuberance will appear on each side, which, rapidly increasing in size, will prove to be the unfolding wings: about a quarter of an hour completes the operation, and the little animal prepares for flight, leaving behind it the perfect silver-like skin of its former body, which with all its legs and other parts remains sticking to the plant.

The cuckoo spit is by some called the frog hopper, from the nimbleness with which it springs to a considerable distance when disturbed.

The most celebrated of all this genus of insects is the *Cicada plebeja* of Linnæus. This is a common species in the warmer parts of Europe, and was once the favourite of the poets. It appears in the middle of summer, and makes the air resound with its shrill chirping noise while it conceals itself among the branches of trees. Many romantic stories have been told of the musical powers of this little creature, and much has been said in favour of its voice: but in reality the sound which it emits is harsh and disagreeable; far from being varied, the same note is incessantly repeated, and that in such a loud tone, that one of them confined in a cage will almost drown the voice of a whole company. This astonishing faculty in so small an object has engaged the attention of some of the most celebrated entomologists, who have found that the sound proceeds from a pair of concave membranes placed on each side the first joint of the abdomen, assisted by a strong muscular apparatus, which are together exerted for the purpose of producing the note.

That the cicada gained great credit for its harmonious voice, may be collected from what antient authors have related respecting two rival musicians, who were playing for a prize, when one of them unfortunately broke the string of his lyre, and would certainly have lost the day, if a com-

passionate cicada had not flown to his aid, and, by supplying the place of the broken string, encouraged him to proceed and gain the palm. This event was commemorated by a statue, in which a man is represented playing upon a lyre with a cicada perched on it. There are likewise allusions to this musical insect in two gems in the Florentine Gallery; one represents the cicada on a lyre, and the other the same insect playing on a Pan's pipe. Anacreon too celebrates this little favourite, and has bestowed upon him the pretty verses with which we have concluded this account:

"Happy insect! blithe and gay,
Seated on the sunny spray,
And drunk with dew, the leaves among,
Singing sweet thy chirping song!

All the various seasons' treasures,
All the products of the plains,
Thus lie open to thy pleasures,
Fav'rite of the rural swains.

On thee the muses fix their choice,
And Phœbus adds his own,
Who first inspir'd thy lively voice,
And tun'd the pleasing tone.

Thy cheerful note in wood and vale
Fills every heart with glee;
And summer smiles in double charms
While thus proclaim'd by thee.

Like gods canst thou the nectar sip,
A lively chirping elf;
From labour free, and free from care,
A little god thyself."

ROSE LOUSE.

GENERIC CHARACTER.

Rostrum bent inwards.
Antennæ longer than the thorax.
Wings erect and either four or none.
Feet formed for walking.
Abdomen generally furnished with two little horns or processes on the hinder part.

SPECIFIC CHARACTER.

APHIS ROSÆ. A. rosæ. *Linn. Syst. Nat. Gmel.* 1. p. 2204.
Aphis viridis, corniculis longissimis, rosæ. *Degeer Ins.* p. 65. no. 10. t. 3. f. 10.
Rose aphis, of a green colour, with very long antennæ.

ROSE LOUSE. *Reaum. Ins.* 3. t. 21. f. 1—4. *Shaw Gen. Zool.* 6. pl. 58.

THIS is the insect which so frequently infests our rose-trees, to the great annoyance of the gardener, who finds it very difficult, if not impossible, to destroy them entirely. They adhere in vast numbers to the branches and under side of the leaves, where they remain so closely wedged together as to give a green appearance to the plant. About the be-

ginning of February they are generally found in abundance upon the tender buds of the rose, and if the weather prove mild they continue to enjoy their situation; but if it should become very cold, most of them will be destroyed, and the plants in a great measure cleared of them.

Although we have selected this species as the one most commonly known to the casual observer, yet there are several others of the same genus; but their habits and manners are so nearly allied that the same history will apply to them all. There is something so curious in the œconomy of these creatures, that entomologists have thought it worth their while to pay particular attention to them, and among the rest the late Mr. Curtis has not been wanting in his endeavours to complete their history. The result of his labours are published in the sixth volume of the Transactions of the Linnean Society; and as he has given by far the best account of these little insects, we shall avail ourselves of his information, taking the liberty, at the same time, to abridge what it would be superfluous for us to introduce.

It appears from the observations of naturalists that these little creatures possess a very wonderful property, the females continuing to produce a great number of generations after being once impregnated. This is so singular a circumstance that nothing but repeated observation could satisfy many of the truth of it. However, the fact is now well established, and Mr. Curtis quotes M. Bonnet in

proof of it. This gentleman took the insects as soon as they were brought forth, and kept each individual separate. The females of these brought forth abundance of young, which he treated in the same manner with precisely the same effect: thus he proceeded to the ninth generation with the same success; and was so far from believing them exhausted, that he thinks it might be carried on to the thirtieth generation.

There is something very singular in the quality of the glutinous liquor voided by these insects. "Were a person," says Mr. Curtis, "accidentally to take up a book in which it was gravely asserted that in some countries there were certain animals which voided liquid sugar, he would soon lay it down, regarding it as a fabulous tale, calculated to impose on the credulity of the ignorant; and yet such is literally the truth. The superior size of the *aphis salicis* will enable the most common observer to satisfy himself on this head. On looking steadfastly on a group of these insects while feeding on the bark of the willow, one perceives a few of them elevate their bodies, and a transparent substance evidently drop from them, which is immediately followed by a similar motion and discharge like a small shower from a great number of others. At first I was not aware that the substance thus dropping from these animals at such stated intervals was their excrement, but was convinced of its being so afterwards; for on a more accurate examination I found it proceeded from the extremity of the ab-

domen, as is usual in other insects. On placing a piece of writing-paper under a mass of these insects, it soon became thickly spotted: holding it a longer time, the spots united from the addition of others, and the whole surface assumed a glossy appearance. I tasted this substance, and found it as sweet as sugar. I had the less hesitation in doing this, having observed that wasps, ants, flies, and insects without number, devoured it as quickly as it was produced.

" In the height of summer, when the weather is hot and dry, and aphides are most abundant, the foliage of trees and plants (more especially in some years than others) is found covered with, and rendered glossy by, a sweet clammy substance, known to persons resident in the country by the name of *honey-dew*: they regard it as a sweet substance falling from the atmosphere, as its name implies. The sweetness of this excrementitious substance, the glossy appearance it gave to the leaves it fell upon, and the swarms of insects this matter attracted, first led me to imagine that the honey-dew of plants was no other than this secretion, which further observation has since fully confirmed. Others have considered it as an exsudation from the plant itself. Of the former opinion we find the Rev. Mr. White, one of the latest writers on natural history that has noticed this subject. But that it neither falls from the atmosphere, nor issues from the plant itself is easily demonstrated. If it fell from the atmosphere it would cover every thing in-

discriminately; whereas we never find it but on certain living plants and trees. We find it also on plants in stoves and green-houses covered with glass. If it exsuded from the plant, it would appear on all the leaves generally and uniformly: whereas its appearance is extremely irregular, not alike on any two leaves of the same tree or plant, some having none of it, and others being covered with it but partially. But the phænomena of the honey-dew, with all their variations, are easily accounted for by considering the aphides as the authors of it; that they are capable of producing an appearance extremely similar to that of honey-dew has already been shown. As far as my observation has extended, there never exists any honey-dew but where there are aphides; such, however, often pass unnoticed, being hid on the under side of the leaf. Wherever honey-dew is observable about a leaf, aphides will be found on the under side of the leaf or leaves immediately above it, and under no other circumstances whatever. If by accident any thing should intervene between the aphides and the leaf next between them, there will be no honey-dew on that leaf. Thus then we flatter ourselves to have incontrovertibly proved that the aphides are the true and only source of the honey-dew."

The sooty appearance which we occasionally find on the surface of the bark and foliage of different trees is owing entirely to the saccharine substance which the aphides deposit, and which, after

remaining a considerable time, greatly disfigures the leaves, and is sometimes mistaken for a black mildew.

In some seasons these insects multiply so exceedingly as to become very injurious to the husbandman, who has no remedy against their baneful effects. Hop gardens are sometimes covered with them; and the plants which before might be in the most flourishing state, are presently so altered in their appearance as to be no longer like the same. Vain would be the attempt to rescue them; the mischief is too extensive: the timely fall of violent rain attended with lightning is said to be very serviceable in clearing the crop, but it may be doubted if the wet has much to do with it, since we find from some experiments made by Mr. Curtis, that these insects can even exist for a considerable time totally under water. On the twelfth of May 1799, this gentleman immersed in a glass of water the footstalk of a leaf of considerable length, taken from a stove plant beset with aphides of a dark lead colour, which were feeding on it in great numbers. On immersion they did not quit the stalk, but immediately their bodies assumed a kind of luminous appearance from the minute bubbles of air which issued from them. They were put under water at a quarter past six in the evening, and taken out at a quarter past ten the next morning, having continued immersed sixteen hours. On placing them in the sunshine, some of them almost immediately showed signs of life, and three out of

four at least survived the immersion. " Many years before this experiment," says Mr. Curtis, " with a view to destroy the aphides which infested a plant in my green-house, I immersed, one evening, the whole plant, together with the pot in which it grew, in a tub of water. In the morning I took out the plant, expecting with certainty to find every aphis dead; but to my great surprise they soon appeared alive and well. When taken from the plant on which they feed, and kept under water, they do not survive so long; their struggling in that case perhaps exhausts them sooner. This part of the subject might perhaps be pushed much further: it is sufficient for our purpose to have shown that wet is not so hurtful to them as is generally imagined."

Mr. Curtis recommends the smoke of tobacco beyond every thing else for the destruction of the aphides. It is obvious that they can only be destroyed on a small scale, viz. in a green-house where a few plants only, if the gardener is careful, will be covered with aphides, and it will be better to remove these into a place where they may be smoked separately, than to be at the trouble and expense of smoking the whole house. It appears that when judiciously applied, the tobacco completely answers the purpose without injuring the plant.

These despoilers of the vegetable kingdom are themselves preyed upon by several insects. One of their most formidable enemies is the coccinella, or common lady-bird. During the severity of win-

ter this insect secures itself under the bark of trees or elsewhere. When the warmth of spring has expanded the foliage of plants, the female deposits its eggs on them in great numbers, from whence in a short time proceeds the larva, a small grub of a dark lead colour spotted with orange: these may be observed in the summer season running pretty briskly over all kinds of plants; and if narrowly watched they will be found to devour the aphides wherever they find them. The same may be observed of the lady-bird in its perfect state. As these insects in both their states are very numerous, they contribute powerfully to diminish the number of aphides. Mr. Curtis mentions another very formidable enemy: it is a very minute black and slender ichneumon fly, which eats its way out of the aphis, leaving the inflated skin of the insect adhering to the leaf like a small pearl. In general the torpid aphis submits quietly to this fatal operation; but this is not the case with all of them, as Mr. Curtis observed the kind which feeds on the sycamore, which has more agility than many of the other species, endeavouring to avoid the ichneumon with great address.

Mr. Curtis is of opinion that these insects are one of the principal causes of the blight of plants, and supposes that they emigrate to different parts of the country at certain periods. He informs us that the common green aphis, which is so generally destructive, lives during the winter season on such herbaceous plants as it remained on during the

autumn, either in its egg or perfect state. As the spring advances the males and females of these insects acquire wings; and thus the business of increase is widely and rapidly extended, as the winged aphides, by hop-planters called the fly, may be seen at this period sitting on plants, and floating in the air in all directions.

Mr. Curtis mentions the observation of Mr. White of Selborne respecting a shower of aphides, as tending to support his opinion of their disposition to emigrate. The account which Mr. White has given of this curious circumstance is as follows: "As we have remarked above, that insects are often conveyed from one country to another in a very unaccountable manner, I shall here mention an emigration of small aphides, which was observed in the village of Selborne, no longer ago than August the first, 1785. At about three o'clock in the afternoon of that day, which was very hot, the people of this village were surprised by a shower of aphides or smother-flies, which fell in these parts. Those that were walking in the streets at that juncture found themselves covered with these insects, which settled also on the hedges and gardens, blackening all the vegetables where they alighted. My annuals were discoloured with them, and the stalks of a bed of onions were quite coated over for six days after. These armies were then no doubt in a state of emigration, and shifting their quarters; and might have come, as far as we know, from the hop-plantations of Kent or Sussex, the wind being

all that day in the easterly quarter. They were observed at the same time in great clouds about Farnham, and all along the vale from Farnham to Alton."

The hop-grounds frequently suffer most severely by these insects. In 1793 they greatly damaged the hops, and in 1798 caused the crop entirely to fail. In the year 1794, which was remarkable for a dry summer, the aphides attacked the peas and beans, while the hops completely escaped. Thus it is uncertain upon what plants they will commit their depredations, as potatoes and even corn have been known to suffer from their visits.

COCHINEAL.

GENERIC CHARACTER.

Rostrum situated in the breast.
Hinder part of the abdomen bristly.
Two erect wings on the males; none on the females.

SPECIFIC CHARACTER.

Coccus Cacti.	C. cacti coccinelliferi. *Linn. Syst. Nat. Gmel.* 1. p. 2220.
	Coccinella alis destituta, corpore rugoso. *Brown Jam.* 435.
Cochineal.	*Degeer Ins.* 6. pl. 80. f. 12—14. *Reaum. Ins.* 4. pl. 7. f. 11, 12. *Shaw Gen. Zool.* 6. p. 191. pl. 61.

Cochineal was known as a drug long before its real nature was determined: some supposed it to be a vegetable, while others thought it an insect. This difference of opinion was owing to the dried state in which it was imported; and its appearance in our shops is so ambiguous, that it would puzzle any one unacquainted with the drug to say whether the substance was of animal or vegetable origin. The history, however, of this useful material is now

fully known, and we find the male insect described as a small fly about the size of a flea, with jointed antennæ and large wings in proportion to the body, which is of a red colour, and terminated by two long filaments: this is the appearance of the male:—the female differs essentially, being destitute of wings, and of an oval shape, with a body at least six times the size of the male. The process which they undergo before we receive them, so completely spoils their shape, that we lose all traces of their legs and antennæ: they appear like irregular grains convex on one side and concave on the other, both sides being marked with transverse streaks or wrinkles. They are of a scarlet colour within, and of a blackish red without; sometimes of a white, reddish, or ash colour.

The cochineal is a native of South America, and the best is said to come from Mexico, where the insects are chiefly cultivated, and are fed on two plants of the same genus, viz. the *cactus cochenillifer*, and *cactus opuntia*, or prickly pear. The female is the officinal cochineal insect; and as they afford a considerable branch of traffic, great care is taken to bring them to perfection. The Mexicans carefully attend to the plants which afford them nourishment, and at a proper season fix to the prickles of the cactus small parcels of the finest moss, each of which is sufficient to make a nest that will contain ten or twelve full-grown female insects. In a few days a numerous progeny is born, which soon leave the moss, and spread themselves over

the leaves of the plants, becoming attached to those spots which they find best adapted to afford them nourishment. Here they remain till they become of a full size, and are then taken off for use. It must be observed that they become torpid when full grown, and it is in this state that they are gathered. In some parts the slaves are not sufficiently careful in picking off the cochineal (which is done with a bamboo twig in the shape of a pen); for instead of confining themselves to the perfect insect, they pick off those which have not arrived at their full size, and thus injure the crop by destroying many females before they have deposited their young.

The insects are converted into a colouring drug by a simple but cruel process. They are collected into a wooden bowl and from thence transferred to a flat earthenware dish, which is placed over a charcoal fire, and thus the insects are slowly roasted alive till all their juices are evaporated. While they are drying, a person continually stirs the mass with a tin ladle, and sometimes sprinkles them with water lest they should burn, which would totally destroy the beauty of the colour. When the operation is completed, they are removed from the fire and assume the well-known appearance of cochineal. Eight hundred and eighty thousand pounds weight of this drug are said to be imported annually into Europe!

There is another species of this genus, the *Coccus ficus*, Linn., or shell lac, which is of considerable service to japanners, &c. These insects inhabit the

trees which are found on the uncultivated mountains on both sides of the Ganges, and are so abundant, that even if the annual consumption greatly exceeded what it does, there would be more than enough to supply the markets. Mr. Kerr, who has given a particular account of this species in the seventy-first volume of the Philosophical Transactions, says, that in the year 1781 gum lac in Dacca was sold for twelve shillings the hundred weight, notwithstanding the greatest part of it is collected in Assam, which is a part of Asia at a great distance from Dacca.

The trees upon which these insects are chiefly found are the *Ficus religiosa* and *Ficus indica*, Linn. The young ones for some time after they are produced, which is in the months of November and December, continue to wander about the branches till they at length fix themselves on the succulent parts of the young shoots. By the middle of January they have all attached themselves to their particular situations; and although they now cease to show any signs of life, yet they appear as plump as before. Their legs, antennæ, and the bristles of the tail, however, are no longer to be seen, and their bodies appear to be glued to the branch by a semi-transparent gelatinous liquid, which completely surrounds them. This liquid gradually accumulates till about the middle of March, by which time it has formed a perfect cell for the insect, which now appears like a smooth red bag, of an oval shape, without life, and full of a beautiful red liquid.

If this red bag is opened in October or November, a number of small oval eggs, or rather young grubs, amounting to twenty or thirty in number, will be found within it. As long as any of the red fluid remains, the young progeny continue within the bag; but as soon as the whole of it is consumed they pierce a hole through the outer covering, and walk out one by one, leaving the empty nest behind them. They generally fix themselves so close together (on account of their immense numbers) that scarcely more than one female in six has room to finish her cell; the others die, and become the food of different insects. The branches of the trees to which they attach themselves suffer so much from the loss of sap, that they seem covered with a red dust, and the adjoining parts wither away. The natives who collect the lac break down these branches and carry them to market.

This production in its natural state is called *stick lac*. After the cells are separated from the sticks and granulated, they are called *seed lac*. This melted by fire and made into cakes becomes the *lump lac*; and the term *shell lac* is given to this substance after it has been liquified, strained, and formed into thin transparent plates.

Before the discovery of America introduced to our notice the cochineal, we were indebted to another species of this genus, the *Coccus ilicis*, or kermes, for the most valuable scarlet dye then in use. This insect adheres to the shoots of the *Quercus coccifera*, or berry-bearing ilex, which is found very

plentifully in many parts of Europe. They appear under the form of smooth shining grains of a brownish red colour, about the size of peas, and covered with a fine brown powder. These grains contain the young kermes, which proceed much in the same manner as the lac insects, till they attach themselves to the young branches, and become the receptacles of a future progeny. The harvest of the kermes is more or less abundant, according to the severity of the winter. They are gathered principally by women, and steeped in vinegar in order to kill the parent, and thus prevent the exclusion of the young animals, which contain the crimson liquor. They are then spread on linen and exposed to the sun, where they are turned two or three times a-day till they become perfectly dry, and are then packed for sale.

It is observed that the scarlet die from this insect is much more durable, though less brilliant, than that from cochineal. The term scarlet in grain, which was given to woollen cloth dyed with kermes, originated from the insect having been considered as a grain.

LEPIDOPTEROUS INSECTS.

BUTTERFLY.

GENERIC CHARACTER.

Antennæ become thicker towards their extremity, and are generally terminated by a knob.

Mouth furnished with a spiral tongue, which the insect can extend and roll up again at pleasure.

Wings, when at rest, erect.

SPECIFIC CHARACTER.

PAPILIO PRIAMUS. P. alis denticulatis holosericeis, anterioribus supra viridibus, macula atra, posterioribus maculis sex atris. *Linn. Syst. Nat. Gmel.* 1. p. 2230.

Papilio with toothed velvet-like wings; upper wings green, with a large black spot; lower wings marked with six black spots.

PAPILIO AMBOYNENSIS, viridi- et nigro-holocericeus insignis. *Vincent. Mus.* 10.

PAPILIO sive ATLAS AMBOYNENSIS, alis superioribus holocericeo-nigris, institis viridibus. *Mus. Petrop.* 664.

PRIAM BUTTERFLY. *Aubent. Misc.* 1. pl. 45. *Jablonsky. Pap.* 1. pl. 1. f. 1, 2. *Shaw Gen. Zool.* 6. p. 207. pl. 65.

ON this splendid and very extensive genus, Nature seems to have lavished her most radiant treasures. We here find a display of colour which nothing can exceed, and frequently trace all the varied tints of the rainbow upon the wings of a single butterfly. As an example of this magnificent tribe of insects we have selected the above species, which was considered by Linnæus as the most beautiful of them all.

When the wings of this butterfly are extended they measure more than six inches from end to end, and the beauty of their surfaces exceeds all description. The ground colour of the upper wings is a deep velvet black edged with a broad irregular border of the most beautiful grass green, which has all the softness and lustre of satin. The same bright green prevails in the lower wings, which are marked with four oval spots of velvet black *, and edged with a border of the same colour; besides these they have an orange-coloured spot on the upper part of each of the inferior wings. Black and gold form the prevailing colours on the body of this splendid insect, and that nothing might be wanting to render it the most beautiful of its species, Nature has decorated the black part with specks of the brightest green.

* In the Linnæan specification six black spots are mentioned, but we have not noticed more than four.

These rare insects inhabit the island of Amboyna, from whence they are brought to England and preserved in the cabinets of the curious.

As the history of any particular individual of this numerous genus does not contain any thing sufficiently interesting to make it of importance to the general reader, we have thought it unnecessary to give more than one example, and shall conclude with a concise description of the different parts of these insects.

The *eyes* of butterflies differ in size, and somewhat in formation. In one species they are large, in another small; in some they describe a larger portion of a sphere than in others; but in all the outward coat has a lustre which reflects from its surface the various prismatic colours. The cause of these different tints is discovered when the eye is examined under a proper magnifying glass; for it will then be found to consist of a great number of sides, or small lenses, each of which reflects a portion of light, and the whole may be compared to a brilliant cut diamond. This disposition of the parts of the eye enables the insect to see perfectly well in every direction, though the whole together is fixed immoveably in the head.

The *trunk* with which butterflies are furnished, is the organ through which they conduct all their nourishment to the mouth. It is a flexible tube placed exactly between the eyes, and when the animal is not in search of food is generally rolled up. With this the butterfly explores the bottom

of a flower, and robs the nectary of its sweets; seated on the edge of the corolla the little animal uncurls its trunk, and directed by an unerring instinct to the part where the honey lies, immediately plunges in its proboscis, and extracts the contents.

The *wings* of butterflies, which constitute the beauty of these insects, owe their opacity to the variegated dust with which they are covered. This dust, which is rubbed off with the slightest touch from the surface of the wing, and disregarded as a mere powder, is nevertheless highly deserving of our notice. Each particle bears some resemblance to the feather of a bird, or rather to a fan, being a flat substance which widens from the point, and is terminated by four or five notches. These scales are arranged in a very beautiful and regular manner on the wings of the insect, one rank being partly covered by the other above it, in the same way as tiles are laid upon a house. By the help of a compound microscope and a deep magnifier, these apparent grains of powder are at once converted into the little scales already mentioned. The wing itself is composed of very thick nerves distributed on a fine transparent film, in which may be seen the sockets contrived to receive the taper end of the scales.

The *body*, which may be divided into the corslet and the abdomen, is frequently so covered with hair that the rings on the latter part of it are not

visible. The corslet, which is more solid than the abdomen, has both the wings and the legs attached to it. The two fore-legs are often so much concealed in the long hair of the body, that it is difficult to discover them, and the insects, from this circumstance, may appear to have but four legs, while they invariably have six.

MOTH.

GENERIC CHARACTER.

Antennæ cetaceous, decreasing in size from the base towards the point.
Wings, when at rest, in general deflected.
Fly in the night.

SPECIFIC CHARACTER.

PHALÆNA MORI. P. alis pallidis; strigis tribus obsoletis fuscis maculaque lunari. *Linn. Syst. Nat. Gmel.* 1. p. 2413.
Wings pale; marked with three obsolete brown bands.

SILKWORM. . *Merian Ins. Eur.* 1. pl. 1. *Reaum. Ins.* 2. pl. 5. f. 2. *Albin Ins.* pl. 12. f. 16. *Shaw Gen. Zool.* 6. p. 280. pl. 77.

THE great service which these insects have been of to mankind from a very early period, has given them a degree of importance above the rest of their tribe; and, as we are much indebted to them for their labours, it will be but just to pay particular attention to their history.

Silkworms are reared in two ways: one is to let them remain at full liberty upon their native trees; the other to keep them at home in a place particu-

larly set apart for the purpose, taking care to supply them every day with fresh leaves. The first method is used in China, Tonquin, and other hot countries, where they are hatched and form their coccoons of silk without requiring any attendance. In those hot climates the butterflies who spring from the worms, or rather caterpillars, choose a proper place in the mulberry-tree to deposit their eggs upon, which being found, they fasten them with a sort of glue with which most insects are naturally supplied for different purposes. These eggs remain there all the autumn and winter without the least injury; and the manner in which they are fixed secures them from the influence of frosts. The insects never leave their eggs till nature has provided for them a sufficient supply of food in the young leaves, which burst from their buds some time before the silk-worms appear. Upon these leaves the little progeny feed with great voracity, and soon increase in size, so that at the end of a few months they distribute upon different parts of the tree little cones of silk, which resemble so many apples of gold amidst the beautiful green that surrounds them. This method of breeding these very useful insects is undoubtedly the best, but it cannot be practised in our cold European climates, where they would be subject to inconveniencies which all our care could not possibly prevent. By nets they might be defended from the depredations of birds, but nothing could secure them from the severity of the cold, or from the violent winds and rain with which we are

so frequently visited, and which would at once sweep away and destroy them all. It is necessary therefore to bring them up in the house; and the manner in which the persons who have the care of silkworms proceed for this purpose is thus described.

A room is chosen in a good air, and where the sun has free admission. This apartment must be defended from the winds by windows well glazed, or frames of strong cloth. In the middle of the chamber several ranges of wicker shelves are placed one above another about eighteen inches apart, and under every range of shelves there is a floor, bordered round with a ledge, which slides into a groove, and may be fixed or displaced at pleasure. The worms are hatched in boxes where the eggs have been previously placed, which are of a straw colour, and about the size of a pin's head. When the worms first leave their eggs, it is customary to put some leaves of the mulberry-tree over the paper of the box where they were hatched; which is then large enough to contain a great number of them, as for the first few days they are little black insects about the size of a small ant. When they have gained a little strength they are distributed upon beds of leaves on the wicker shelves in the middle of the room, round which there is a free passage for the person in attendance. Every morning a fresh supply of leaves is lightly scattered over them in an uniform manner, at the same time the stale ones are removed, and care taken that the insects are not carried away with them. Cleanliness is highly necessary in rearing these little animals, as nothing

injures them so much as moisture and impurity. In order to preserve the silkworms from the distempers to which they are liable, the persons who have the care of them are attentive to gather their leaves in a dry season, and preserve them in a place where no moisture can come, as wet is exceedingly prejudicial to the caterpillars, and drying the leaves takes up more time than the young nursery can well spare, as they come into the world with a determination to make the best use of the short period allowed them, and are therefore always feeding most voraciously till they prepare to pass into the chrysalis state. Leaves of lettuce or holly-oak are occasionally given them when the mulberry leaves happen to fail, but they have little relish for this food; they only submit to it from necessity, and the silk they then spin is of an inferior quality. Fresh air must be admitted into the room from time to time, as upon that and cleanliness the welfare of the silkworms greatly depends.

Having thus described the manner in which these useful insects are reared, we shall proceed to trace them through the different stages of their growth.

We have already noticed that when the silkworm first leaves the egg it is extremely small, and perfectly black. In a few days it begins to assume a whitish hue, or rather an ash gray, and in about a week after its birth it has grown to the length of a quarter of an inch, soon after which it suffers a temporary lethargy, and sleeps for two or three days: towards the expiration of this time, the little animal becomes

violently agitated, and grows almost red with the efforts it uses; its skin wrinkles and shrinks into folds, and the insect at length divests itself of it, and throws it aside with its feet. It now appears in a new habit, is very much increased in size, and feeds voraciously for five days longer, when it again becomes torpid, and once more quits its covering. It experiences two more attacks before it has arrived at its full growth, when it is rather more than an inch long. After this period it only continues to feed five or six days before it becomes transparent, with a tinge of yellow, and leaves traces of its silk wherever it passes. It now ceases to enjoy itself any longer, loses all relish for its favourite food, and prepares for its approaching change into a chrysalis, by constructing a little cell of the most exquisite beauty, where it remains enclosed a month or five weeks, and sometimes longer. But before we extricate our little prisoner from its temporary tomb, it will be proper to describe the manner in which it spins the cone or ball of silk in which the chrysalis is so carefully wrapped.

In the body of the insect there are two long and slender bags that lie above the intestines, and contain a sort of gum, of the colour of a marigold, of which the worm makes its silk. The apparatus designed for the purpose of spinning the cone, has not been unaptly compared to a wire-drawer's machine. This is a plate pierced with holes of unequal dimensions, through which gold or silver threads may be drawn to any degree of fineness. The silkworm has

under her mouth such a kind of instrument perforated with a pair of holes, through which she draws two drops of the gum that fills her bag; and as every thread proceeds from two gum-bags, it is probable that each supplies its own, which immediately after leaving the animal loses its fluidity and acquires the necessary consistence. The silkworm is never deceived in adjusting the dimensions of the two apertures, or calculating the due thickness of the thread: she always makes it sufficiently strong to support the weight of her body, and unites the two threads together by glueing one over the other with her fore paws.

When the creature has fixed upon a proper situation where it may construct its cell without interruption, it begins to move its head in all directions, in order to fasten its threads on every side. This first work looks like confusion, but it is not without design. The worm, in the beginning, neither arranges its threads nor disposes one over another; but contents itself with distending a sort of cotton or flue, to keep off the rain; for they constantly make use of the same means in the house which nature has ordained them to use for their defence in the open air.

"When my curiosity," says the Abbe La Pluche, "led me to know how they spun and placed their beautiful silk, I took some of them and frequently removed the flue with which they first attempted to make themselves a covering; and as I weakened them exceedingly, when they were at last tired of

beginning anew, they fastened their threads upon what came in their way, and began to spin very regularly in my presence, bending their heads up and down, and then crossing on every side. The worm at that time confined its motions to a very contracted space, and by degrees had entirely surrounded itself with silk. The remainder of the operation is invisible, but one may guess how it was accomplished. The animal, to finish its mantle, drew out of its bag a gum, which it spun into a less delicate silk, and then thickened it with a strong glue, which served to bind all the last ranks of this silk over one another."

Thus we may plainly distinguish three coverings, which are entirely different from each other. Externally the cone is composed of the flue, or cottony substance that keeps off the rain; the fine silk within this forms a tissue that prevents all access of air; and the glued silk next the body of the chrysalis not only defends it from water and air, but also renders the inside of this habitation inaccessible to the cold. The cone is like a pigeon's egg, and more pointed at one end than the other. The worm never fails to fix her head opposite the pointed extremity, as she is conscious that part is not so strongly cemented nor so exactly closed as the rest, and therefore better fitted for the passage of the future moth, which will have to force its way out of the cone.

After the worm has quite completed her cell she resigns herself with patience to her fate, and re-

mains quiet during the appointed time, when the chrysalis becomes converted to a perfect moth, and the new animal, impatient of confinement, presses with its head against the point of the cone; which, being weak in that part, gradually yields to its efforts; the opening becomes sufficiently enlarged, and at last the moth comes forth. At the bottom of the cone may be found the ruins of its former state, consisting of the head and entire skin of the worm. When first the moth leaves its cell it appears exhausted with fatigue, and merely recovers its strength to propagate its species; for the male dies soon after his union with the female, who only survives him till she has fulfilled the duty appointed her by Providence, in laying the foundation of a future progeny.

Before the moth leaves the cell it discharges a liquor that greatly injures the silk; to prevent which, the persons who have the care of silkworms collect the cones before the chrysalis contained in each is arrived at perfection, and, by exposing them to a sufficient degree of heat, kill the animal, and thus preserve the silk. It is necessary, however, to save a few of them to recruit the stock for the ensuing year; but a very small number will be sufficient, as one female will sometimes lay above five hundred eggs.

The best cones are strong, without any spots, and of a clear colour; those of a bright yellow yield more silk than the others; but the pale ones are more esteemed, as they take particular colours better, and,

having less gum in their composition, do not lose so much in boiling. Before the silk is separated the cones are put into vessels of water, each of which is placed over a small fire, and the ends of the threads are found by stirring the cones gently about with a whisk made for the purpose. These ends are drawn through a hole in a piece of iron placed at the edge of the vessel which contains the cones. It is usual also to join together the silk of several cones, as the threads are too fine to be wound off separately; eight or ten threads are generally united, sometimes more, according to the degree of strength of which it is intended to make the silks. The cones remain in the water till they cease to furnish any more silk; but the last part of it is wound off by itself, as it grows weaker towards the ends, and is not of so beautiful a colour.

A single cone, when unravelled, will yield an astonishing length of silk. The Abbe La Pluche made the experiment upon two cones, from one of which he wound off nine hundred and twenty-four feet, and from the other nine hundred and thirty: we are to remember likewise that the thread is double and glued one over the other through its whole length, so that it may justly be said to measure nearly two thousand feet. It appears that this length of silk weighed only two grains and a half.

In many parts of Bengal and the adjoining provinces, the natives spin silk from a worm which differs specifically from the European. The caterpillar grows to the length of four inches; it is three

in circumference, and resembles in colour the leaves of the plant it feeds upon. These insects are so abundant that a large quantity of silk is manufactured from them, which is said to be very durable, and is woven into a kind of cloth much worn by the Bramins and other sects of the Hindoos. The cocoons from whence the silk is obtained are as large as a small hen's egg; and we are informed that when the caterpillars are about to pass into the chrysalis state, each of them connects two or three leaves into an exterior covering, by means of a glutinous fluid with which the insect is provided; these leaves serve as a basis to spin the complete case or cocoon in. This curious habitation is suspended from a branch of the tree in a wonderful manner by a thick, strong, consolidated cord, spun of the same materials as the cocoon, from the bowels of the animal. The case is of an exact oval shape and exceeding firm texture; in it the animal remains dormant, and perfectly protected from injury, during nine months of the year. When the moth is ready to come forth, which is in July, it discharges from its mouth a large quantity of liquid, with which the upper end of the case is so perfectly softened, that the moth is enabled to escape from its prison without much difficulty, and we are told that this purpose is always effected in the night.

When the people go in search of these silkworms they repair to the jungles, and under the byer and asseen trees they find the excrement of the insect, on which they examine the tree; and when they discover the worms, they cut off a sufficient num-

ber of the branches with the young brood upon them; these they convey to their homes, and distribute the branches on the asseen tree, but put none on the byer tree, as the insect is not so partial to its leaf, and consequently does not produce so good a cone when fed on it. The hill people guard the insects constantly while in the worm state, to preserve them from birds by day and from bats by night.

Before the cocoons are wound off, the natives put them into a ley made of plaintain ashes and water for about two hours, after which they are taken out and put in their wet state into an earthen pot; those which are properly softened are first applied to the reel, and they are thus used in succession for four or five days, till the whole are wound off. A small common reel of four bars is used for this purpose, which is turned by the right hand, whilst the thread of four or five cocoons passes over the left thigh of the spinner, who at the same time gives the thread a twist with his left hand upon his thigh.

An interesting paper on the subject of these silkworms, by Dr. Roxburgh, is published in the seventh volume of the Transactions of the Linnean Society, from whence we have derived our information, and where the reader will find a more particular account than the plan of this work will allow us to give. We cannot dismiss these insects, however, without noticing the amazing distance which they are sometimes known to fly when in the moth

state. In a letter which Dr. Roxburgh procured from a friend relative to these silkworms, is the following passage: "I have frequently endeavoured to detain the males of the jarroo species, and have kept them locked up in a box for that purpose; but whether they did not like to make free with their female relations, or from what other cause I know not, but I could never obtain a breed in the domestic state, and the efforts of the male to escape were wonderful, and always effectual. The accounts given by the natives of the distance to which the male insects fly are very astonishing. I have put at different times and occasions, innumerable questions to them on this subject, and they assure me that it is no uncommon practice amongst them to catch some of the male moths, and put a mark on the wings previous to letting them fly, the marks of different districts being known. I have been told that it has been thus ascertained that male moths have come from a distance equal to a hundred miles and upwards. I of course cannot vouch for the truth of this, but have no hesitation in declaring that I believe it."

It appears that in antient times the culture of silk was entirely confined to China, and that the Romans were supplied with it from that country, through the hands of the Persians, for several centuries. Robertson informs us that silk was first introduced into Europe by two Persian monks, who, having been employed as missionaries in some of the Christian churches which were established (according

to Cosmas) in different parts of India, had penetrated into the country of the Seres, or China. There they observed the labours of the silkworm, and became acquainted with all the arts of man in working up its productions in such a variety of elegant fabrics. The prospect of gain, or perhaps an indignant zeal excited by seeing this lucrative branch of commerce engrossed by unbelieving nations, prompted them to repair to Constantinople. There they explained to the emperor the origin of silk, as well as the various modes of preparing and manufacturing it, mysteries hitherto unknown, or very imperfectly understood in Europe; and encouraged by his liberal promises, they undertook to bring to the capital a sufficient number of these wonderful insects, to whose labours man is so much indebted. This they accomplished by conveying the eggs of the silkworm in a hollow cane. They were hatched by the heat of a dunghill, fed with the leaves of a wild mulberry-tree, and they multiplied and worked in the same manner as in those climates where they first became objects of human attention and care. Vast numbers of these insects were soon reared in different parts of Greece, particularly in the Peloponnesus. Sicily afterwards undertook to breed silkworms with equal success, and was imitated from time to time in several towns in Italy. In all those places extensive manufactures were established and carried on with silk of domestic production. The demand for silk from the East diminished of course; the subjects of the Greek emperors

were no longer obliged to have recourse to the Persians for a supply of it, and a considerable change took place in the nature of the commercial intercourse between Europe and India.

It was not till towards the end of James the First's reign that the broad silk manufacture was introduced into England, notwithstanding the planting of mulberry-trees for the nourishment of the insects had been earnestly recommended from the throne at an earlier period. About the year 1620, however, the manufacture was prosecuted with great vigour and advantage, so that the monarch was no longer at a loss for a pair of silk stockings, as it is said once happened to him while king of Scotland. Silk at that time being very scarce in the country, the king wrote to the earl of Mar, one of his friends, to borrow a pair of silk stockings, in order to appear with becoming dignity before the English ambassador; concluding his letter with these words; "for ye would not, sure, that your king should appear like a scrub before strangers."

SPHINX.

GENERIC CHARACTER.

Antennæ thicker in the middle than at the extremities.
Wings deflected, the outer margins declining towards the side.
Flight, slow and heavy.

SPECIFIC CHARACTER.

Sphinx Atropos. . .	S. alis posterioribus luteis, fasciis fuscis; abdomine luteo, cingulis nigris. *Linn. Syst. Nat. Gmel.* 1. p. 2378. The lower wings yellow, marked with brown bands; abdomen yellow, with rings of black.
Death's Head Sphinx.	*Reaum. Ins.* 1. pl. 14. 2. pl. 24. *Schæff. Icon.* pl. 99. f. 1, 2. *Cram. Pap.* 7. pl. 78. f. A. *Shaw Gen. Zool.* 6. p. 217. pl. 74.

The remarkable resemblance of a death's head upon the thorax of this insect, together with the sharp sound, like the squeaking of a mouse, which it emits when either disturbed or irritated, has been the cause of much uneasiness to those who are inclined to be superstitious; and the poor animal from these natural circumstances has been generally

dreaded by the common people wherever it appears, being considered by them as the harbinger of approaching death. We are informed by Reaumur, that one of these insects happened to fly one evening in at one of the windows of the dormitory of a French female convent, which disastrous accident threw all the members into the greatest consternation.

The great beauty of the caterpillar from whence this moth proceeds is particularly deserving of our notice. It has seven bands of a mixed violet and sky blue colour upon a ground of bright yellow: these bands meet on the back, each pair forming an angle by their union, and the effect of the whole is increased by a number of jet black spots, which are sprinkled along that part of the back. A singular horn is situated on the last joint of the body; it is of a yellow colour, hangs like a tail over the end of the body, and has a rough surface. This caterpillar is the largest of its kind in Europe: it measures near five inches in length, and is thick in proportion. The potatoe and the jessamine are said to be its favourite food; and as it conceals itself during the day, and feeds only at night, it is not easily detected: in fact, these insects are very rare in this country, except in particular years, when we are assured they become too common; so much so, that in 1804 they were very prejudicial to the crops of potatoes in some parts of Cornwall, &c. The caterpillar retires to a considerable depth underground for the purpose of completing its trans-

formation, where it changes its gaudy attire for a plain coloured case, in which it remains from September till the following June or July.

This creature is quoted by Dr. Shaw as a fine instance of the relation which the papilionaceous tribe bear in passing through their different stages, to the awful mystery revealed in the sacred writings, and thinks it equal to any of the order as a type of the resurrection. He very properly remarks that the silk-worm is wrongly chosen for this purpose, as it neither undergoes its change beneath the surface of the earth, nor bursts from its tomb with any beauty to recommend it beyond its fellows: whereas, on the contrary, the Sphinx atropos is buried deep within the ground for nine months of the year, and then, leaving its sombre tomb, mounts into the air arrayed in colours which cannot fail to excite the admiration of all who behold them.

The different stages through which these insects pass are indeed wonderful, and such as are calculated to make a strong impression on contemplative minds. Their progress has been marked by many, and we must ever feel indebted to the subject, since it has called forth the following beautiful lines from the pen of Dr. Shaw:

> The helpless crawling caterpillar trace,
> From the first period of his reptile race.
> Cloth'd in dishonour, on the leafy spray
> Unseen he wears his silent hours away;
> Till satiate grown of all that life supplies,
> Self-taught, the voluntary martyr dies.
> Deep under earth his darkling course he bends,
> And to the tomb, a willing guest, descends;

There, long secluded in his lonely cell,
Forgets the sun, and bids the world farewell.
O'er the wide waste the wintry tempests reign,
And driving snows usurp the frozen plain.
In vain the tempest beats, the whirlwind blows;
No storms can violate his grave's repose.
But when revolving months have won their way,
When smile the woods, and when the zephyrs play,
When laugh the vivid world in summer's bloom,
He bursts and flies triumphant from the tomb,
And while his new-born beauties he displays,
With conscious joy his altered form surveys.
Mark, while he moves amid the sunny beam,
O'er his soft wings the varying lustre gleam.
Launch'd into air, on purple plumes he soars,
Gay Nature's face with wanton glance explores;
Proud of his various beauties wings his way,
And spoils the fairest flowers, himself more fair than they!
And deems weak man the future promise vain,
When worms can die, and glorious rise again?

NEUROPTEROUS INSECTS.

DRAGON FLY.

GENERIC CHARACTER.

Antennæ shorter than the thorax.
Mouth armed with jaws.
Wings expanded; without folds.

SPECIFIC CHARACTER.

LIBELLULA GRANDIS. L. thorace lineis quatuor flavis, corpore variegato. *Linn. Syst. Nat. Gmel.* 1. p. 2625.
Thorax marked with four yellow lines: body variegated.
Libellula alis glaucescentibus, thoracis lineis quatuor flavis. *Syst. Nat.* xii. 2. p. 903.
GREAT DRAGON-FLY. *Reaum. Ins.* 6. pl. 35. f. 3. *Roes. Ins.* 2. pl. 4. f. 14. *Schæff. Icon.* pl. 2. f. 4.

THIS beautiful insect, which measures near four inches in length, is frequently seen in the summer, flying with great rapidity along the sides of our rivers and brooks, often settling on the leaves of

aquatic and other plants, from whence it darts like an arrow on being disturbed. The colours of this insect are very splendid. Its large blue eyes, contrasted with its greenish yellow thorax and variegated body, give it a very elegant appearance, which is again assisted by its double pair of fine gauze-like wings.

There is something very striking in the different stages of this animal's existence. Who would suppose that so brilliant an insect as this is, with so much strength and vivacity, had formerly resided for nearly two years at the bottom of the very water on whose surface he is now flying in search of prey? Would any one imagine that all these gaudy colours were once hid under the appearance of a dirty brown-coloured grub? Yet nothing is more true; and the history of this wonderful transformation is nearly as follows:

The eggs are deposited by the female in the water, and immediately sink to the bottom, hanging together in clusters like grapes. After a certain time they are hatched into flattish larvæ with six legs. These larvæ or caterpillars cast their skins several times before they arrive at their full size, when they are of a dirty brown colour, and of a very disagreeable appearance. There is but little difference between the larva and the chrysalis; perhaps it chiefly consists in the rudiments of the future wings, which may be traced when the insect is in this advanced state. They are exceedingly voracious while they continue to inhabit the

water, and prey upon whatever they can meet with of a manageable size. For this purpose the head is furnished with a flattened appendage, having a joint in the middle, and two very strong claws at the end. When the animal is not in action, this formidable apparatus is folded up so as to cover the face; but when the creature intends to attack another insect, this jointed instrument is stretched out, and becomes of the greatest use in securing the prey. After continuing in the water for two years, they prepare for their last great change; for a state so different from the former in every respect, that they rather appear new animals of another species, than the same body differently attired. In order to accomplish this change they ascend the stem of some water-plant, and, when arrived above the surface, firmly grasp the plant, and for some time continue immoveable, as if meditating on the approaching change. What follows is singularly curious. The skin of the head and back, after a slight effort, bursts open, and exposes the real head and eyes of the libellula in all their brilliancy of colouring. From this opening proceeds the head, then the body and legs of the animal; the empty case being left behind attached to the plant, where it exhibits a very perfect model of its former state. At first the new-born insect is but very weak, and sits quietly upon the reeds or rushes to recover itself. During this time the wings, which were before folded up and compressed into the small space they occupy under the skin of the chrysalis, begin

by degrees to expand themselves, and in about half an hour they have acquired a sufficient degree of firmness, and are moreover completely smooth and dry; so that the animal is shortly afterwards enabled to try its strength in the air. This surprising operation is generally accomplished in the fore part of the day, and during a clear sunshine. The total change effected in this animal's habits and constitution, in passing from one state to the other, is too obvious to escape our notice; and we cannot help being greatly astonished when we consider that the animal, which but an hour ago could not exist for any length of time out of the water, would now almost immediately be drowned if plunged into that element. In disposition, however, the creature remains the same, and, far from being idly or innocently employed, is in fact the greatest tyrant of the insect tribe, and, like the hawk among birds, is constantly hovering about in search of prey. The blue fly, the bee, the wasp, and the hornet, are alike the objects of its choice: it will even attack a large butterfly, and, tearing it wing from wing, devour the whole body in less than a minute. These insects seize their prey with their claws, and tear it in pieces with their teeth.

As the wings of the libellula are long, and the legs short, they seldom walk, but are ever seen either resting or flying. For this reason, they always choose dry branches of trees or shrubs to remain on; and when they have refreshed themselves a little, they renew their flight. Thus they are seen adorn-

ing the fields in summer with a profusion of beauty, lightly traversing the air in a thousand directions, and exposing the most brilliant colours to the sun. The garden, the hedges, the meadows, and the rivulets, are animated with their sports, and there are but few persons brought up in the country who have not employed a part of their childhood in the pursuit.

The other species of this genus are inferior in size, but not in beauty, to the great dragon-fly. They have one thing which is common to them all; the wonderful conformation of the eye, which when properly prepared forms one of the most curious and pleasing objects for the microscope which can possibly be employed. The cornea consists of an amazing number of hexagonal lenses: if this part be separated from the rest of the eye, placed between two pieces of talc, and exposed to a high magnifying power, it will appear perfectly transparent, and exhibit the lenses of which it consists, in a highly satisfactory manner.

EPHEMERA.

GENERIC CHARACTER.

Mouth without either teeth or palpi.
Wings erect; hinder ones much shorter than the others.
Tail furnished with appendices resembling hairs, or bristles.

SPECIFIC CHARACTER.

EPHEMERA VULGATA. E. alis fusco-reticulatis maculatisque, corpore fusco. *Linn. Syst. Nat. Gmel.* 1. p. 2628.

Wings reticulated and mottled with brown; body brown.

Ephemera cauda triseta, alis nebuloso-maculatis. *Syst. Nat.* xii. 2. p. 906. no. 1.

COMMON DAY-FLY. . *Degeer Ins.* 2. p. 7. no. 1. pl. 16. f. 1. *Sulz. Ins.* pl. 17. f. 103. *Shaw Gen. Zool.* 6. p. 249. pl. 81.

WE are now about to describe a fly whose duration in its perfect state extends so short a term, that it is scarcely introduced to the world before it is obliged to part with life. In its fly state the ephemera is a very beautiful insect; it is of a greenish brown colour, with transparent wings, and three very long black bristles at the end of the body.

The larva, which is supposed to continue two years at the bottom of the water, is about an inch long, and is furnished with several lateral appendages like fins; it has likewise three bristles at the tail, which are equal in length to the whole body. The change from the larva to the perfect insect, which in many of the tribe is both a painful and laborious operation, is effected by this little animal with the greatest ease. When the time approaches for the change to take place, the inhabitant of the water rises to the surface, its skin bursts, and from the cavity thus formed issues the fly, whose wings are immediately unfolded, and the new insect launches into the air, quitting for ever an element which is no longer congenial to its nature. After this it quits a second skin, and becomes a perfect ephemera. Myriads are thus produced, who sport about the banks of the river for a short time, and then fall to the ground. Their numbers are so incredible that they form a thick crust upon the earth where they fall, and we are told by Scopoli that the countrymen in the duchy of Carniola carry them into the fields for the purpose of manure.

The larvæ of this, as well as of others of this genus, form tubular hollows in the banks of rivers. These are so numerous, that the banks of some rivers are quite studded with them, and they are made like syphons, with two holes, through which the insect has free admission. As it is necessary that these habitations should be always under the

surface, the insect digs fresh holes, when from any cause the waters are found to decrease.

Ephemeræ always effect their transformation in the evening, and the report of the multitudes which covered the Seine every night, excited the curiosity of that famous entomologist M. Reaumur, who in August 1738 waited for some time after sun-set on the banks of that river in order to observe the phænomenon. Disappointed, however, of his purpose, he returned home with a tub partly filled with their holes and larvæ; but had scarcely set it down, when every part of the earth that was above the water in the tub, was covered with ephemeræ, in the act of emerging from their former skins. The quantities which flew from the tub, whose number seemed to increase every minute, induced this gentleman to pay another visit to the river, where he was greatly surprised at the quantity of ephemeræ which filled the air, and which, according to his account, surrounded him like a thick fall of snow. This amazing fall prevailed to such a degree, that he had scarcely remained a few minutes in one place, before the step where he stood was completely covered with their bodies to the depth of two or three inches. A thick coat of these insects covered the water for at least six feet from the bank, and those which the current carried down the river were immediately replaced by others. M. Reaumur was occasionally obliged to abandon his station and retreat to a higher place, in order to avoid the

shower of ephemeræ, which falling very thick, and in an oblique direction, greatly annoyed him by striking against his face and flying into his mouth and ears. The effect of a candle held in the midst of these insects is thus described by this intelligent observer: "The light of the candle occasioned a spectacle altogether different from any thing that can be observed in any kind of meteorological shower: it was enchanting when once observed. The most unobserving of my domestics could scarcely ever have been tired of admiring it. No astronomic sphere was ever formed so complicated as it was, nor furnished with so many circular zones in every possible direction, having the flame of the candle for their common centre. Their number appeared to be infinite, having all possible degrees of obliquity with respect to each other. Each zone was formed by an uninterrupted string of ephemeræ, which, as if tied together, followed each other close in the same line: they seemed to form a circular ribbon of silver, deeply indented on its edges; a ribbon formed of equal triangles put end to end, so that the angles of those that followed were supported by the base of that which preceded, the whole moving round with great quickness. Ephemeræ, whose wings only were then distinguishable, and which circulated around the light, formed this appearance. Each of these flies, after having described one or two orbits, fell to the earth, or into the water, but without having been burned by the candle."

It seems that the ephemeræ only continue to rise above the surface about an hour every evening, after which time the shower formed by their bodies entirely ceases, and no more of them are to be seen above the river. Notwithstanding the perfect ephemeræ are so easily killed that almost any object they touch becomes fatal to them, yet the larvæ are so tenacious of life, that Swammerdam tells us he even pierced one of them with a pin, which, although in this manner fastened to a board, lived during the whole of the next day.

The *Ephemera vulgata* is well known to our anglers by the name of May-fly, and it is frequently used as a bait for trout, being a favourite food of that fish during the season.

The little time allotted these insects in their last state is employed, by the males, in merely fluttering above the surface of the water till they drop; they have very little activity, and seem scarcely born for any other purpose than to die. The females, on the contrary, have got a most important duty to fulfil: they have to provide for a future generation, and the short period of their existence is taken up in depositing their eggs. Two large packets of eggs, each containing from three to four hundred, are enclosed within the body of every female ephemera, from whence they are excluded at the same moment, and fall together in one mass upon the water. Nature has provided for the sudden alteration, which the loss of so large a quantity of eggs at one time might make in the constitution

of the animal, by a couple of small bladders, which it has the power of filling with air immediately after they are excluded, and thus restoring the equilibrium.

There are several species of this genus, which are not easily distinguished from each other, especially the smaller kinds. Among them is one which greatly resembles the *Ephemera vulgata*, except in the colour, which is white: this is described by Swammerdam, and quoted as a remarkable instance of the shortness of animal life; the insect assuming its winged state, fulfilling the purposes of its birth, and perishing, in the course of the same evening. The species mentioned by Reaumur may possibly be distinct from our English kind, as it appears at a different season, and has not so long a term allowed for its existence.

LION-ANT.

GENERIC CHARACTER.

Mouth armed with jaws, furnished with two teeth and four long palpi.
Antennæ club-shaped; as long as the thorax.
Tail (in the male) provided with a kind of forceps.
Wings deflected.

SPECIFIC CHARACTER.

Myrmeleon Formicarius.	M. alis fusco-nebulosis: macula alba marginali posteriore. *Linn. Syst. Nat. Gmel.* 1. p. 2643.
	Wings clouded with brown; a white spot on each posterior margin.
	Hemerobius Formicaleo. *Syst. Nat.* x. p. 550. no. 4.
	Formica Leo. *Geoff. Ins.* 2. p. 258. pl. 14. f. 1.
Lion-Ant.	*Reaum. Ins.* 4. pl. 11. f. 6. 8. pl. 14. f. 18, 19. et pl. 32, 33, 34.
	Schæff. Icon. pl. 22. f. 1, 2. *Shaw Gen. Zool.* 6. p. 260. pl. 84.

This creature in his larva state lives by rapine, and yet is denied the power of pursuit. He cannot advance in search of his prey with the least

chance of success, being less calculated for moving forwards than in the contrary direction; therefore what he wants in agility he is obliged to make up by stratagem: for this purpose he prepares a trap, into which the unwary insects fall, and become an easy prey to their formidable antagonist. The body of the animal bears some resemblance to a spider; it is of a dirty brown colour, marked with black spots, and composed of several flat rings which slide over each other: many small tufts of dusky hair appear on each side of the abdomen. The head of this singular insect is small, and the jaws long, curved, about the sixth of an inch in length, and provided with sharp-pointed teeth on their internal surfaces. His sight is very quick; for he starts from the smallest object that he discovers, if it is at all calculated to injure him.

When the lion-ant intends to prepare an ambuscade, he chooses a bed of dry sand at the foot of a wall, or in some secure situation where he can be defended from wind and weather. He is obliged to make use of the driest sand he can get, because a solid soil, as well as a moist sand, would not prove tractable under his operations. When he intends to hollow the trench where he ensnares his game, he bends the hinder part of his body, which tapers into a point, and then plunges it into the sand, which he throws up in his rear; and thus, by repeating his efforts and taking several rounds, he at last traces out a circular furrow, whose diameter always equals the depth to which he intends to sink it.

Near the edge of the first furrow he opens a second, and then a third, and several others which are smaller than the preceding, and sinks himself from time to time deeper in the sand, which he throws aside with his horns, on the edges of the furrows, and to a much greater distance, always marching backward in a spiral line. The repeated strokes of his head whirl the sand out of the circle, and gradually scoop out a cavity; in which operation he exceeds the best engineers, and describes a perfect circle without the assistance of compasses. He likewise gives the slope of earth which he hollows all possible solidity. In this dexterous manner with great labour he completes his trench, which resembles an inverted cone, or rather the inside of a funnel.

When this creature is newly hatched he opens a very small furrow, but as he increases in size he digs one more spacious, the cavity of which is two inches or more in diameter, and as much in depth. When the work is completed, he forms his ambuscade, and conceals himself under the sand in such a manner that his horns exactly wind round the point in which the bottom of the funnel terminates. In this situation he watches for his prey, hiding himself in such a manner that his two horns only are seen at the bottom of the pit. The sides of his pitfall are made of the most loose and crumbling materials, so that, if an insect has the misfortune to fall down the slope, it stands but little chance of returning alive. When he is apprised by the fall

of a few grains of sand that something is in the pit, he immediately rushes forth to seize the prey, which meets with inevitable destruction, unless it has agility enough to be capable of remounting in an instant; and even then the lion-ant has a stratagem which frequently succeeds in bringing back the unfortunate animal to the bottom of the pit. This he effects by whirling a quantity of sand into the air above the height of the flying animal, which proves a dreadful shower to such a tender creature as a gnat or an ant. The unfortunate insect, blinded and overwhelmed in this manner, by the tempest that pours down from every quarter, and hurried away by the instability of the sand that rolls from under its feet, falls between the jaws of the enemy, who plunges them into its body, drags it under the sand, and then feasts upon the victim. When nothing is left but the carcass drained of its juices, he is particularly careful to remove it out of sight. The appearance of a dead body would deprive him of future visits, and bring his place of residence into disrepute: he therefore extends his long jaws, and, with a sudden spring, tosses the slain half a foot beyond the trench: and if this should happen to be disconcerted, and filled up by such a proceeding; or if the aperture becomes too large for the depth, and the declivity loses its proper slant, he repairs the whole as soon as possible, that it may be ready to receive a new victim. In this manner the creature proceeds; and such is his great patience that he will sometimes pass whole weeks at

the bottom of the pit, watching for prey; and, what is very extraordinary, will fast during the time. These insects are enabled to abstain from food for a great length of time: one of them has been known to live above six months in a box exactly closed up, where he had no other accommodation than sand. We must conclude that this temporary fasting is not exactly to the creature's mind; for, when plenty of game falls into the pit, he attacks it most voraciously, and at the same time shows a very malignant spirit, since he will leave one insect half devoured to kill any other that may be within his reach.

When this insect is about to pass into the state of a chrysalis, previous to appearing in his last form, he no longer troubles himself with his pit, but begins to work in the sand, where he strikes a multitude of irregular tracks, and becomes so agitated that his body is covered with a viscous humour: after these violent workings have continued some time, he plunges into the sand, and unites all the grains he touches by means of the glutinous fluid with which he is covered.

With these sandy particles, and the dried glue that consolidates them, he forms a crust which encompasses his whole body, like a little ball of about half an inch in diameter, in which the animal reserves himself a competent space for motion. He is not satisfied with a bare wall, which would inevitably chill him, but spins out of his own bowels a thread, which in fineness infinitely surpasses that

of the silkworm, which we have so much admired. This thread he fastens, first to one place, and then extends it to a second, still crossing and interlacing it. By this means he hangs all his apartment with a satin tinged with the colour of pearls, and perfectly beautiful and delicate. In this work all the propriety and convenience is confined to the inside; for nothing appears without but a little sand, which confounds and incorporates the mansion with the contiguous earth. And now he lies secreted from the pursuit of ill-disposed birds; he rests in oblivion, and lives in perfect tranquillity; whereas he would infallibly be lost, were the outside of his habitation ornamental enough to attract the view of any creature whose curiosity might prove injurious to him.

In this manner he lives secluded from the world five or six weeks, and then divests himself of his eyes, horns, paws, and skin. His spoils sink to the bottom of the ball like a heap of rags; all that now remains is a chrysalis which has other eyes and paws, other entrails and wings enfolded with a skin, and hid in a nutrimental liquor that gradually dries around it, in the same manner as is customary with butterflies when they divest themselves of their vermicular spoils to assume the form of aurelias. When the limbs of the new animal have acquired their necessary tone and activity, he tears away the tapestry of his apartment, and pierces through the walls; for which purpose he employs a couple of teeth, and by repeated efforts enlarges the opening, thrusts out half his body, and at last entirely quits his solitary

seat. His long form, that winds like the volute of an Ionic capital, and is included within the compass of a quarter of an inch, begins to unfold and extend itself, and in an instant stretches to the length of an inch and a quarter. His four wings, which were contracted in little folds, and whose dimensions did not exceed the sixth of an inch, in the film that sheathed them, begin to be expanded, and in the space of two minutes shoot into a greater length than the whole body. In short, the malignant lion-ant assumes the appearance of a beautiful dragon-fly, who, after he has for some time continued immoveable, and astonished as it were at the glorious prospect of nature, flutters his wings, and enjoys a liberty with which he was unacquainted in the obscurity of his former state. His former barbarity and pernicious inclinations are no longer known; he divested himself of these passions when he changed his coat; and now appears entirely a new creature, as well calculated to range about in the air, as he was before to burrow in the sand.

The female lays her eggs in the sand, from whence proceed the little malignant creatures we have just described: they are found in many parts of the continent, but are strangers in this country.

HYMENOPTEROUS INSECTS.

GALL INSECT.

GENERIC CHARACTER.

Mouth armed with jaws; no proboscis.
Sting spiral, and mostly concealed within the body.

SPECIFIC CHARACTER.

CYNIPS QUERCUS FOLII. C. nigra, thorace lineato, pedibus griseis, femoribus subtus nigris. *Linn. Syst. Nat. Gmel.* 1. p. 2650.
Of a black colour; thorax marked with lines; feet gray; thighs black beneath.

GALL INSECT. . . . *Reaum. Ins.* 3. pl. 39. f. 14—17. *Roes. Ins.* 3. *App.* pl. 52, 53. *Shaw Gen. Zool.* 6. 267. pl. 88.

THOSE excrescences found upon the oak-leaf, and which are commonly called gall-nuts, are the produce of this insect. The female cynips prefers the oak before all other trees for the purpose, and in the month of July pierces the leaves, depositing an

egg in each little hole, to the number of seven or eight on the same leaf. At the same time she injects into each cavity a peculiar and corroding liquor, which so interrupts the circulation of the sap, that the part near the wound is discoloured, and a gradual enlargement takes place. This continues to increase, and towards the end of the month the excrescence is as large as a marrowfat-pea; after which it increases rapidly in size, and by the beginning of October has attained its full growth; its surface at this time is dried by the external air, and it has assumed the roundness of a kernel. This little ball gradually receives its nourishment, and vegetates like the other parts of the tree.

Under this strong roof, and within the substance of the ball, is hatched the little worm; which on slitting open its apartment is found snugly embedded in the centre, and somewhat resembling the small maggot occasionally found in the hazel-nut. The interior and pulpy part of the nut affords the creature a sustenance accommodated to its nature. It eats and digests it, till its transformation first into a chrysalis, and then to a fly; after which it gnaws its way through the walls of its prison, and immediately launches into the air.

Upon examining those gall-nuts that were produced in the beginning of summer, a small opening will be immediately perceived through which the fly escaped; but it must be observed that when the right owner quits the habitation it does not cease

to be useful, as the cavity is frequently occupied by a small spider, who watches her opportunity to slide in and take possession of the habitation, where she spins her web and ensnares the unwary insects that venture into her cell. The case, however, is different with the gall-nut that grows in the autumn. The cold weather frequently comes on before the worm is changed into a fly, or can disengage itself from its confinement. The nut falls with the leaves without injuring the enclosed insect, which passes the winter on the ground, securely lodged in the body of the nut, and buried under a heap of leaves that secure it from all injury. But this warm and commodious apartment, which proves so snug a habitation in the winter, becomes a prison in the spring, and the little animal, excited to action by the first sensation of warmth, is all impatience to be gone: it accordingly begins its operations, and by degrees opens for itself a passage, through which it forces its way, and leaves its former lodging never to return again.

The best galls are imported from the Turkish dominions, and are known by the name of galls of Aleppo: they are generally of a blueish colour, unequal and warty on the surface, and of a close compact texture. Another sort is imported from some of the southern parts of Europe, of a whitish colour, smooth, round, and easily broken: they are of a much larger size, but not by any means so useful as the Aleppo galls, two parts of these being equivalent at least to three of the others.

There is hardly a plant but what is pierced by some species of this genus, and which produces some of these nuts, as they are termed, of all sizes and colours. The rose, among other plants, has its gall, which makes a very singular appearance, resembling a quantity of branched moss, in the centre of which is included the young maggot. Some trees have their leaves entirely encrusted with these excrescences; particularly the willow, whose leaves are sometimes completely covered with them, occasioned by a small cynips (*C. viminalis* Linn.) which lies securely imbedded during the winter in one of the tumours on the surface of a fallen leaf.

SAND-WASP.

GENERIC CHARACTER.

Mouth armed with jaws: no tongue.
Antennæ divided into ten articulations.
Wings extended, and laid horizontally upon the back.
Sting sharp, and concealed within the abdomen.

SPECIFIC CHARACTER.

SPHEX SABULOSA. S. nigra hirta, abdominis petiolo biarticulato, segmento secundo tertioque ferrugineis. *Linn. Syst. Nat. Gmel.* 1. p. 2723.

Black and hairy: pedicle of the abdomen biarticulate: the second and third segments of a rusty brown colour.

SAND-WASP. . . *Degeer Ins.* 2. p. 148. no. 4. pl. 28. f. 27. *Frisch. Ins.* 2. pl. 1. f. 6, 7. *Schæff. Icon.* 83. f. 1.

THE singular manners of many of the insect tribe are as interesting and as worthy of observation as those of a higher class. They are frequently disregarded because of their diminutive size, while the œconomy of the larger animals is always considered of sufficient importance to fix our attention.

Amongst the many little creatures which we have lately described, there is not, perhaps, one whose manners are better deserving of our notice than the sand-wasp. This insect was particularly observed by Mr. Ray, who tells us that he saw one of them dragging a green caterpillar thrice her own size, which she laid down near the mouth of a hole that she had made in the earth: having thus far executed her purpose, she proceeded to remove a little ball of earth with which she had covered the mouth of the vault, and immediately descended under ground; here she staid a short time, and then ascending to the surface, seized the caterpillar and drew it down with her into the grave. After this was accomplished she returned, and proceeded to fill up the hole by taking some little globules of earth and rolling them one by one into the vault, occasionally scraping the dust in with her fore-feet in the manner of a dog. Thus she continued alternately rolling in pieces of earth, and scraping in the dust, till the hole was full. She was observed sometimes, during this operation, to go down into the grave, and once or twice flew to a fir-tree in the neighbourhood for some purpose or other, returning again each time to her work. At length the hole being filled and made level with the surface of the earth, that its entrance might not be discovered, this ingenious insect took two fir-leaves that were near, and laid them close to the spot to mark the place.

It should be noticed that the caterpillar is buried

by the wasp in order to secure a provision for her future family, since she always lays her eggs in the dead body before she closes the grave.

The common sand-wasp is found in Norfolk and Suffolk in sandy situations, and may be easily distinguished from the rest of the genus by the manner in which it carries its abdomen. This, according to Mr. Kirby, forms nearly a right angle with the thorax while the insect is flying.

The different species of this genus are very savage in their manners, and will attack insects of a size much superior to themselves. In their combats they have a double advantage, being not only very strong, and armed with hard and sharp jaws, but having likewise a sting in the tail, through which they inject a poison that presently proves fatal to their wounded antagonist. They proceed to the attack with great ferocity, and, having inflicted a wound, retire to a distance and observe the effect of the poison; which has no sooner killed the creature than they drag it to their nest for the use of the young. Their voracity equals their courage, and their daintiness, if we may believe others, exceeds both; since they only eat the eyes, the small threads that serve as a brain, and a very little of the body. Thus fifty insects scarcely serve one of them for a meal, and the mangled remains are constantly to be seen about the mouth of their retreat.

Their cells are cylindrical and formed of clay, about three inches long, and as thick as the little finger. They generally place them in a sheltered situation,

against the timbers under the roof of houses, or under pales. Eight or ten of them are joined together and divided into several apartments, in each of which the species called the *blue sand-wasp* deposits an egg, and stuffs the apartment with several insects to support the future offspring; after which the orifice is closed. While they are about this work they constantly make a humming noise, though perfectly silent at other times. Spiders seem the principal victims of these little animals, which their situation gives them frequent opportunities of obtaining. As a proof of their great strength we shall quote Mr. Catesby, who once saw one of these wasps drag an exceeding large spider up a wall to its nest, which being caught and weighed, was found to be eight times as heavy as the fly.

The young sand-wasp remains in the clayey cell during the winter, in which time it passes through the state of a chrysalis, and in the spring gnaws its way out, perfectly equipped, and ready to join its companions in the air.

COMMON WASP.

GENERIC CHARACTER.

Mouth armed with jaws; no tongue.
Upper wings folded.
Sting sharp and pointed; concealed within the abdomen.
Body smooth; without hair.

SPECIFIC CHARACTER.

VESPA VULGARIS. V. thorace utrinque lineola interrupta, scutello quadrimaculato, abdominis incisuris punctis nigris distinctis. *Linn. Syst. Nat. Gmel.* 1. p. 2750.

A broken line on each side the thorax; scutellum marked with four spots; abdomen marked with distinct black points.

COMMON WASP. *Degeer Ins.* 2. p. 111. pl. 26. f. 7. *Reaum. Ins.* 6. pl. 12. f. 7, 8. *Schæff. Icon.* pl. 35. f. 4. *Shaw Gen. Zool.* 6. p. 285. pl. 95. *Nest.* pl. 96.

THE Abbé La Pluche begins his account of these insects in the following pleasing but allegorical manner: "While I was employed in digesting my remarks on the changes that happen to flies of every species, a person came to acquaint me, that some husbandmen who were at work in the neighbourhood had

found a curiosity which had filled numbers who came to see it with admiration. Upon this I immediately went, like other people, to take a view of it, and really the thing deserved it; for they had found an entire city buried in the earth, and such a city as was capable of lodging between eleven and twelve thousand inhabitants. The structure of this city was perfectly ingenious, though very different from ours; the wall is not a simple enclosure surrounding the place, but a great dome that entirely covers and encompasses it on every part. After they had carefully surveyed it, they could only discover two gates; and as the darkness was very great under the dome, they had demolished part of it to have a clear prospect into the different quarters of the city. But here another scene of astonishment opened; the streets are not ranged like ours, in side lines, but piled over each other in different stories, which are separated by several ranks of columns; so that they are rather porticos than streets; the uppermost of which rises on the second, the second on the third, and so in succession, reckoning downwards. The houses are of equal dimensions, and thick set against one another in the substance of the vault. All the buildings compose one and the same order, and are likewise on a level on each story, and covered with a flat terrace, or common roof, made with a very binding gum, and as smooth as a marble pavement. Here the inhabitants walk between the pillars that support another vault with its range of houses. There are eleven of these porticos, or

vaults, all of the same structure, and raised with the nicest symmetry and correctness of design. It is the obscurity alone that disfigures the work. I did not so much as see the remains of any lanthern, or other contrivance, to illuminate the city."

It will he hardly necessary to observe, that under the figure of a city, the Abbé has been giving the general description of a wasp's nest. This is indeed a most ingenious structure, and highly deserving the particular account which we shall now proceed to give of its formation.

About midsummer these little architects seek for a subterranean cavity that has been begun by field-mice, moles, or rats; or else they dig one for themselves, generally on the side of a bank or any rising ground, that the water may flow down below their place of residence, which would otherwise greatly annoy them. When they have chosen a proper situation, they begin to work with amazing industry, and their first care is to enlarge and widen the cavity; which they do by scooping out the earth and carrying it away to a distance. This appears an astonishing labour for insects to undertake, yet they are perfectly formed for the purpose, being provided with excellent tools; viz. a trunk extending from their mouths, two saws on each side, which play to the right and left against each other, and six strong muscular legs to support them. Their activity must be very great, since in the space of a few days they build under ground a habitation above a foot high, and as much in breadth. Whilst

some are digging, others are in the fields seeking materials for the edifice. As they proceed, they strengthen the roof of the cave and prevent its falling in by cementing it with glue; they then affix it to the foundation of their building, which they continue to finish downwards, closing it at the bottom.

The materials with which they build their nests are bits of wood and glue: the male wasps are dispatched to cut the former out of the frames of windows, or from old rails and posts, which they meet with in the fields or elsewhere. In this employ they are very active, and will saw and carry away a vast quantity of minute shivers, which they take up in bundles in their claws; and, when arrived at the nest, knead the whole together, by letting a few drops of a glutinous liquor fall upon the mass. The whole is then worked into a paste, and placed on that part of the building where the walls and partitions are intended to be made. The paste is then spread out by the workman with his trunk and paws, who constantly moves backwards all the way. When the composition is reduced to a level surface, the wasp returns to the place where he began, and repeats the same operation, in the same retrograde manner, till the lump of wood and glue is beat out so exceedingly thin, that the finest paper is hardly to be compared with it. The wasp, having completed his work on the first parcel of materials, returns to the fields for more, which he kneads in the same manner, placing layer upon layer; and thus

he continues, at the same time assisted by his fellow-labourers, till a sufficient quantity is collected and cemented together with some of their natural glue, so as to form the grand cupola which bends over the whole habitation. The cells and columns are composed of the same materials, and they somehow contrive to make the cement which forms the latter of a much firmer texture than the rest, as if they were aware that the parts which sustain the pile should have the most solidity. Two openings are made in the walls of their habitation, one of which serves as a passage of entrance into the edifice; the other leads out of it: through the first of these the wasps enter with their burthens, while those which are going to the fields pass out at the other, so that by this contrivance they never interfere with each other. The building is divided into several stories, or horizontal floors of combs; each floor supported by its respective columns, composed of a vast assemblage of hexagonal cells placed with the utmost regularity by the side of each other, and made of an ash-coloured substance resembling paper. It is worthy of observation that these creatures make their cells of the best possible figure for the purpose that could be chosen. Were they round, they would only touch one another in a single point, and the void interval would be quite lost; had they been triangular or square, they might certainly have been very well connected together; but then the angles within would have been lost, because the animal which is to inhabit them is round.

Hexagons approach the nearest to a circular figure, and have all their sides exactly adhering to each other; so that there is no useless or unnecessary vacancy between them, and every lodge, weak as it is, becomes firmly fixed by its coincidence with others.—Sufficient room is left between the different stories for the wasps to have a free passage from one to the other.

The inhabitants of these curious mansions may be divided into three kinds. First, the females, who are large, and originally very inconsiderable in number. Secondly, the males, who are more numerous and nearly as large. Lastly, the mules, that is to say, wasps that are consigned to the most laborious employments, and are neither males nor females; these are much smaller than the others, but so numerous that they form the commonalty of the nation. There are also three kinds of labours wherein the wasps are employed. First, the building of the nest; secondly, the providing of food; and thirdly, the laying of eggs, and the care of their young. The first of these labours we have already considered, but it remains for us to give some account of the other two.

Wasps are bold, rapacious, and troublesome insects: they are very injurious to gardens, being extremely fond of fruit, and therefore frequently lodge themselves in the neighbourhood of grapes, peaches, apricots, &c., upon which they commit the most unmerciful depredations. All sorts of sweets, indeed, are so much to their taste that there

is no danger they will not encounter to procure them. The honey hoarded up by the industrious bees is too great a temptation for them to withstand, and the plunderers frequently suffer for their temerity in attacking a hive. When these favourite sweets are not to be procured, they range to a distance in search of prey, visit the kitchen and the larder, and sometimes carry off bits of flesh half as large as themselves to their nest, where the provision is equally distributed among the young ones. These insects are to other flies, what the eagle and the hawk are to the rest of the feathered tribe. Wherever they fly the air is deserted around them, and every little insect retires in a fright. The butchers avail themselves of this general panic, and very generously present the wasps with a bit of liver when they visit the shambles: by this means they prevent the filthy blow-fly from approaching their shop; for whilst these creatures are regaling themselves with the liver, there is no reason to fear that any fly or other insect will come near the place. Part of this food is carried home and freely distributed amongst the other wasps, and they are even said to retain a portion of the juice of fruits, which after their arrival at the nest they will discharge from their mouths for the benefit of their companions.

At the bottom of each cell may be discovered a little white transparent egg, which is fastened with a viscous substance to preserve it from injury. Into this cell the dam frequently enters, and apparently

communicates a genial warmth to the egg in order to facilitate the birth. In about eight days after they are laid, the worms are hatched, and immediately require the attention of the mothers, who are very careful to nourish them, and proceed from nest to nest, distributing the provisions with the utmost equality, and feeding them as birds feed their young, by giving each of them a portion from her mouth. This business is conducted with great celerity; and it is really astonishing to see with what quickness the female runs along the cells of the combs, to give each worm its portion of nourishment. The worm by degrees increases in bulk and thrives very successfully, filling the whole apartment with the roundness of its form. In process of time the worm grows so large as to be incommoded for want of room, and then it is ready to pass into another state of existence, or rather of temporary death. Previous to this change it ceases to eat, and begins to spin a very fine silk, one end of which is glued to the opening into the apartment; and this being repeatedly crossed, at length forms a kind of light stuff, which perfectly closes the mouth of the passage. In this retirement they continue for nine or ten days, during which time they divest themselves of their skin, the spoil falls to the bottom of the cell, and nothing now remains but a white nymph, which gradually disengages her feet and wings, and acquires the form and appearance of a perfect wasp. Impatient of restraint, the enclosed animal with its teeth destroys the beautiful cover-

ing which it before took so much pains to make, and struggles to escape. First it extends one horn, and then another; to these a paw succeeds; the head grows visible next, and the aperture widens with the efforts of the insect's body, till at last it comes out a perfect wasp. His first employment is to wipe off the humidity from his little wings with his hind feet, which brush them for some time; after which he springs into the air, and flies to the fields to pillage with the rest of the species, whose address and malignity he begins to imitate from that day. Within twelve hours after the transformation, astonishing as it may appear, the young wasps have been seen foraging for provision, and feeding the worms in the cells.

During the heat of summer this colony exists in all its vigour, and every one of the inhabitants has its respective share in the labour of the day allotted it; but as the season advances, their enterprising spirit begins to abate, they plunder with less voracity, are not so bold in their attacks, and confine themselves more to the nest, making but short excursions, and those near home, in the noon day heats. This languor increases with the approaching of winter; and as they hoard up no store for their future support, not even providing in one day for the wants of the next, their situation begins to be calamitous, and, in the end, drives them to the cruel resolution of sacrificing their growing progeny to the necessity of the times. This barbarity is

generally put in force about the beginning of October, when the first sharp cold begins to be felt. At this time every nest presents a scene of desolation. The grubs are dragged from their cells, and destroyed by the wasps before the door of the habitation, where the ground appears covered with their dead carcases; and those combs which before were filled with living animals, are now completely deserted. Many of those which remain to inhabit the nest, find it insupportable during the severe weather, and fly in search of warmer situations; while the few who pass the winter within their city, are either benumbed or killed by the frost; so that, out of perhaps eight or nine thousand wasps, but ten or twelve are found alive in the spring.

From so small a remainder it seems scarcely possible that a new colony should be raised by the next summer; yet the difficulty vanishes when we consider the great fecundity of the female wasps, one of which is sufficient to raise a new swarm. The female begins to accomplish this purpose, by building two or three cells that form a little cluster, glued by the stalk to the top of a cavity of her own contrivance. There she lays two eggs, which are soon hatched into worms; and in a short time they relieve the mother from the care of their maintenance, by shutting the entrance of their cell and passing into their dormant state. While they are thus enclosed, the female has time to hatch more eggs; and the other two, coming soon after to matu-

rity, break out of their confinement, and begin to work with the mother insect. In about fifteen days the last brood add to the number. Thus is the community daily increasing, till the young ones become breeders in their turn; and in this manner is a whole swarm raised before the month of July, consisting of nine or ten thousand wasps.

BEE.

GENERIC CHARACTER.

Mouth armed with jaws, and furnished with a proboscis, enclosed in a bivalve sheath.

Wings extended and without folds.

Females and neuters provided with a sting concealed in the abdomen.

SPECIFIC CHARACTER.

APIS MELLIFICA. COMMON BEE.

A. pubescens, thorace subgriseo, abdomine fusco, tibiis posterioribus ciliatis; intus transverse striatis. *Linn. Syst. Nat. Gmel.* 1. p. 2774.

Body downy; thorax grayish; abdomen brown; legs hairy behind, and striated transversely on the inside.

APIS DOMESTICA sive VULGARIS. *Raj. Ins.* p. 240.

APIS GREGARIA. *Geoff. Ins.* 2. p. 407. no. 1. *Reaum. Ins.* 5. p. 21. 23. *Sulz. Ins.* pl. 19. f. 123. *Shaw Gen. Zool.* 6. p. 189. pl. 98.

THE history of this industrious insect affords one of the most interesting subjects in the whole range of animated nature; therefore it is not surprising that such ample details should have been written

by different authors. Reaumur and Swammerdam have both expatiated at large upon the nature of the bee; but their accounts have been almost superseded by the elaborate treatise of Mr. John Hunter, published in the Philosophical Transactions for the year 1792. To this treatise we shall frequently have occasion to refer, as it is founded on the actual observation of a man of science.

These little animals form a lodgment either in the hollow of a tree, the cavity of a rock, or in a hive they have accidentally found. There they bring up their young, and dwell very peaceably together, as long as their habitation is sufficiently spacious and convenient; but when their numbers multiply to such a degree as to straiten them for room, the old bees, in whom a sort of sovereignty seems to be vested, command all the younger members to seek a new settlement; which command is generally obeyed without attempting to resist, as a refusal to retire is always productive of a battle. On a certain day, commonly in the month of June, the young bees, with the queen at their head, leave the hive in quest of a new habitation. But it should be observed, that, previous to their going off, they hang about the mouth of the hole, or door of the hive, for some days; and if it should chance to be cold or wet in any part of the time, the old bees compassionate their case, and re-admit them till the weather is more propitious. As a sufficient proof that swarming is an act of necessity, the

young brood will never leave the hive if it is sufficiently enlarged in its dimensions to contain them. For some evenings before they finally depart, a strange noise is heard in the hive, resembling a kind of ring, or the sound of a small trumpet.

When the young colony have taken flight, they wander with a buzzing noise through the air in search of a commodious retreat; and after flying about, seemingly in great confusion, they fix themselves in a cluster upon the branch of a tree, or in the hollow trunk, and sometimes in holes or clefts leading to some hollow place. When the queen is settled in the new situation, wherever it may be, the rest of the swarm soon follow, and in about a quarter of an hour the whole body seem to be at ease. It sometimes happens that there are two or three queens to a swarm, and the colony is divided into parties; but when this is the case the matter is soon settled, as they generally differ in strength, and the bees presently desert the weakest to put themselves under the protection of the most powerful sovereign. It is said that the deserted queen does not long survive this defeat; she takes refuge under the new monarch, and is soon destroyed by her jealous rival. Till this cruel execution is performed, the bees never go out to work; and if there should be a queen bee belonging to the new colony left in the hive, she always undergoes the fate of the former.

After the young bees have settled themselves to their satisfaction, they begin their labours by build-

ing a commodious habitation for themselves and their future family. To accomplish this necessary operation they divide themselves into four bodies, one of which is consigned to the fields to collect materials for the structure; the second temper what the first bring home, form the outlines of the work, and partition off the cells, which are polished and completed by the third band; who not only adjust the angles, but remove the superfluous wax, and give the work its necessary perfection. It belongs to the fourth band to bring provision to the labourers, who are too much engaged to leave the building and provide for themselves. Those who have noticed the operations of these ingenious insects through a glass hive, describe the manner in which the labourers are fed by the attending bee. When they are in want of provision, which often happens, they express their meaning by signs. The labourer who has an appetite, bends down his trunk before the caterer, to let him know that he is inclined for food; upon which the other opens his bag of honey, and pours out a few drops, which may be distinctly seen rolling through the whole length of his trunk, that sensibly swells in every part through which the liquor flows. When this little repast is over, the labourer again returns to his task.

In describing the formation of the comb, we cannot do better than follow the account of Mr. Hunter, who tells us that " the cells, or rather the congeries of cells, which compose the comb, may be

said to form perpendicular plates or partitions, which extend from top to bottom of the cavity in which they build them, and from side to side. They always begin at the top or roof of the vault, in which they build, and work downwards; but if the upper part of the vault to which their combs are fixed is removed, and a dome is put over, they begin at the upper edge of the old comb, and work up into the new cavity at the top. They generally may be guided, as to the direction of their new plates of comb, by forming ridges at top, to which they begin to attach their comb. In a long hive, if these ridges are longitudinal, their plates of comb will be longitudinal; if placed transverse, so will be the plates; and if oblique, the plates of comb will be oblique. Each plate consists of a double set of cells, whose bottoms form the partition between each set. The plates themselves are not very regularly arranged, not forming a regular plane where they might have done so; but are often adapted to the situation or shape of the cavity in which they are built. The bees do not endeavour to shape their cavity to their work as the wasps do, nor are the cells of equal depths, also fitting them to their situation; but as the breeding cells must all be of a given depth, they reserve a sufficient number for breeding in, and they put the honey into the others, as also into the shallow ones.

"The attachment of the comb round the cavity is not continued, but interrupted, so as to form passages; there are also passages in the middle of

the plates, especially if there be a cross stick to support the comb; these allow of bees to go across from plate to plate. The substance they use for attaching their combs to surrounding parts is not the same as the common wax; it is softer and tougher, a good deal like the substance with which they cover in their chrysalis, or the humble bee surrounds her eggs. It is probably a mixture of wax and farina. The cells are placed nearly horizontally, but not exactly so; the mouth raised a little, which probably may be to retain the honey the better: however, the rule is not strictly observed; for often they are horizontal, and towards the lower edge of a plate of comb they are often declining. The first combs that a hive forms are the smallest, and much neater than the last, or lowermost. Their sides, or partitions between cell and cell, are much thinner, and the hexagon is much more perfect; the wax is purer, being probably little more but wax, and it is more brittle. The lower combs are considerably larger, and contain much more wax, or perhaps, more properly, more materials; and the cells are at such distances as to allow them to be of a round figure; the wax is softer, and there is something mixed with it. I have observed that the cells are not all of equal size, some being a degree larger than the others; and that the small are the first formed, and of course at the upper part where the bees begin, and the larger are nearer the lower part of the comb, or last made: however, in hives of particular construction, where

the bees may begin to work at one end, and can work both down and towards the other end, we often find the larger cells both on the lower part of the combs and also at the opposite end. These are formed for the males to be bred in; and in the hornets' and wasps' combs, there are larger cells for the queens to be bred in: these are also formed in the lower tier, and the last formed.

"The first comb made in a hive is all of one colour, viz. almost white; but is not so white towards the end of the season, having then more of a yellow cast."

There are some cells much larger, and having a wider mouth than others; these are the royal cells, and Mr. Hunter has observed as many as eleven in the same hive. They are mostly formed on the edge of the comb, and are made of softer wax than the others; they are likewise of an inferior quality, not above one-third of wax entering into their composition, the rest, according to the opinion of Mr. Hunter, being farina.

As soon as a few combs are formed the female bee begins to lay her eggs; and this duty it appears is confined to the queen, notwithstanding the assertion of Riem, that the labourers occasionally perform this office. The first eggs in the season are those which produce labourers, the next males, and afterwards probably the queen: this is the progress in the nest of the wasp, hornet, humble bee, &c. The eggs are laid by the queen at the bottom of the cell, and she regularly proceeds from chamber

to chamber, depositing one in each. She peoples ten, twelve, and sometimes more cells at each fecundation; continuing to deposit her eggs as fast as new cells are formed. Mr. Hunter observes, that each egg is attached at one end to the bottom of the cell, in either a perpendicular or oblique position, by means of a glutinous covering, and that a limited time seems appointed for laying, since, in a new swarm which he noticed, this necessary business did not last above a fortnight.

When the eggs are hatched, which is in about five days, the young maggot appears coiled up in the bottom of the cell, in some degree surrounded with a transparent fluid. The care of these maggots falls to the share of the labourers, the queen being exempt from this trouble; by which it appears she is an hereditary sovereign: she never exerts herself, as the head of other tribes are obliged to do at first, who seem rather to work themselves into royalty, than come naturally by their honours. It is easy to detect the bees feeding the young maggot; and, indeed, these hardy creatures might easily be brought up by any person who would be attentive to feed them, as they readily open their two lateral pincers to receive the food, which they swallow with voracity. The maggot proceeds through the chrysalis state much in the same manner as the wasp, spinning, like that insect, a silken covering for the mouth of its cell, and breaking through its prison at the appointed time for its appearance in the world.

There is a substance in all hives called bee-bread, which is as common among these insects as any thing belonging to their community: whenever a hive is taken, a quantity of this substance is found within it; and it seems to be so essential, that a certain portion is deposited in the first formed cells, and great care taken to cover it with wax, in order to preserve it till wanted. If a cell filled with this substance be laid open, it will be found composed of layers of different colours. This is particularly visible in glass hives, where the cells are attached to the sides, and frequently expose the different strata above mentioned. It is this substance which the bees bring on their legs, and which consists of the farina of plants. For the purpose of conveying this bee-bread to their hive, Nature has formed two spoon-shaped cavities within their hinder legs, and it is common in the summer season to see the little industrious creatures loaded with this commodity to the very top of their thighs. They collect their farina from different flowers, and deposit it within their cells in a very curious manner. "On viewing the hives," says Mr. Hunter, "we often see bees with this substance on their legs, moving along on the combs, as if looking out for the cell to deposit it in. They will often walk over a cell that has some deposited in it, but will leave that and try another, and so on till they fix; which made me conceive that each bee had its own cell. When they come to the intended cell, they put their two hind-legs into it, with the two fore-

legs and the trunk out on the mouth of the neighbouring cell, and then the tail, or belly, is thrust down into the intended cell; they then bring the leg under the belly, and turning the point of the tail to the outside of the leg, where the farina is, they shove it off with the point of the tail. When it is thus shoved off both legs, the bee leaves it, and the two pieces of farina may be seen lying at the bottom of the cell; another bee comes almost immediately, and, creeping into the cell, continues about five minutes, kneading and working it down into the bottom, or spreads it over what was deposited there before, leaving it a smooth surface."

The œconomy of these ingenious insects is really wonderful. They are possessed of a kind of foresight which enables them to provide for futurity with the utmost prudence. All their actions are regulated with propriety, and nothing superfluous is to be found in the hive, while every thing that is necessary is provided. Not a grain of the bee-bread is wasted, lest they should be obliged to seek for more at a time when they are otherwise engaged. Mr. Hunter conceives this substance to be the food of the young maggots; for, when he examined the stomach of one of these animals, he found it full of a similar substance, only softer, as if mixed with a fluid; but he never opened any of them which contained a particle of honey: therefore there can be little doubt but this matter is collected for the young brood, as honey is for the support of the old bees. Among the many instances

of a sagacious œconomy which actuates this busy community, may be noticed the following:

Whenever a cell of honey is opened for the sake of its contents, the cover which enclosed the sweets is carefully deposited in a magazine appropriated for the purpose; and when a young bee frees itself from its prison, by breaking down the partition of wax that shuts it up, two old bees immediately present themselves, and carry away all the remains of this waxen partition; after which they immediately repair the ledge of the cell, and bear all the wax that is left to the same repository, where it is laid up for future purposes.

The bees begin to collect their honey as soon as the season for laying the eggs is over, and each cell is filled with it immediately after the enclosed chrysalis has arrived at maturity, and forced its way out. The honey is extracted by the bee from that part of a flower called the nectarium, and it is then conducted by the little animal into a receptacle called the honey-bag, which appears like an oblong bladder; and its situation within the body is well known to children in the country, who destroy many bees to come at its contents. When a bee has collected enough to fill this bag, it flies to the hive and returns the honey into a cell; after which it flies off for a fresh supply, and thus continues going and coming till its task is completed. As soon as a cell is full of this delicious fluid, it is carefully covered with pure wax, and is to be considered as store for the winter.

The honey which these insects collect will differ in flavour, according to the country where it is produced: much seems to depend on soil and situation, and the honey from Narbonne is particularly prized for its excellence. Bees frequently make long excursions into the neighbouring countries in search of those flowers which yield the most delicious sweets, and these are generally said to grow in a dry and steril soil. The Abbé La Pluche mentions this circumstance, and informs us that it was confirmed to him by a gentleman with whom he was travelling from Chalons upon the Marne to Charleville. "We were about a league and a half from the estate of this gentleman," says the Abbé, "which lies in the valley, on the edge of the lovely meadows of Attigny: as yet we saw nothing but heath, and could not discover any village for above a league in circumference. 'Do you take notice,' said he, showing us a crop of buck-wheat, which refreshed us with a very agreeable scent: 'do you take notice of my servants who are dispersed about the country, and are all at work for me.' But perceiving that we did not understand his meaning;—'This is the whole mystery,' continued he: 'those bees, who are flying among the flowers, come hither from a distance of two or three leagues. We daily see them forsake our gardens, and take their flight over the meadows, despising the oil and fertility of our valleys. In short, they continue their progress to the mountains and plains of Champaigne, where they find lavender, thyme, sweet

marjoram, buck-wheat, and several other plants, very little cultivated, but of a most delicate sap. You will find bees all the way from hence to my estate; and some curious observers are persuaded they have seen them, thrice in one day, take a journey of a league and a half, or two leagues, to furnish their table to their palate.'"

When the cold sets in, the bees become very quiet, and continue in their hives, huddled together, during the winter. They now reap the fruits of their industry, and open those cells of honey which they so carefully set apart in the summer, for their sustenance in time of need. It appears that their consumption of food is in proportion to the coldness of the season, and that, consequently, in a cold week they will eat more honey than when the weather is moderate. This was proved by Mr. Hunter, who made several experiments to ascertain the fact, and constantly found the result as stated above.

In a fine open day, however, in the middle of winter, they become very lively and active, leaving the hive and flying about, as if they very much enjoyed the opportunity.

The *queen bee*, either from her rarity, or from her dignified situation in the hive, has attracted general attention; and every one wishes to see her, though she is by no means readily distinguished amongst the multitude. She confines herself very much to her cell, and seldom appears in public. Whenever she does, a number of bees follow in

her train, and the whole hive seems in commotion, hanging together by their legs, so that in less than a minute they form a large veil, behind which it is impossible to discover any thing that passes. This is a very odd ceremony; but the fact seems well established, though it will be difficult to assign any good reason for its performance. It is in these rounds that the queen lays her eggs, proceeding from one chamber to the other, till her task is finished.

As this is a bee of importance, it will be proper to pay her all due respect: we shall therefore give a particular description of her form, for which we must stand indebted to Mr. Hunter, who has taken much pains to observe every thing relating to these wonderful insects. His account is as follows:

"The queen, the mother of all, in whatever way produced, is a true female, and different from both the labourers and the male. She is not so large in the trunk as the male, and appears to be much larger in every part than the labourers. The scales on the under surface of the belly of the labourers are not uniformly of the same colour, over the whole scale; that part being lighter which is overlapped by the terminating scale above, and the uncovered part being darker; this light part does not terminate in a straight line, but in two curves, making a peak; all which gives the belly a lighter colour in the labouring bees, more especially when it is pulled out or elongated.

"The tongue of the female is considerably shorter

than that of the labouring bee, more like that of the male; however, the tongues of the labourers are not all of equal length, but none have it so short as the queen.

"The size of the belly of the female of such animals varies a little, according to the condition they are in: but the belly of the male and the labourer has but little occasion to change its size, as they are at all times nearly in the same condition with regard to fat, having always plenty of provision: but the true female varies very considerably; she is of a different size and shape in the summer to what she is in the winter; and in the winter she has what may be called her natural size and shape: she is, upon the whole, rather thicker than the labourer; and this thickness is also in the belly, which probably arises from the oviduct being in the winter pretty large. The termination of the belly is rather more peaked than in the labourers, the last scale being rather narrower from side to side, and coming more to a point at the end. The scales at this season are more overlapped; which can only be known by drawing them out. In the spring and summer she is more easily distinguished: the belly is not only thicker, but considerably longer than formerly; which arises from the increase of the eggs. We distinguish a queen from a working bee, simply by size, and in some degree by colour; but this last is not so easily ascertained, because the difference in the colour is not so remarkable in the back, and the only view we can commonly get of her is on this part: but when a hive is killed, the best way

is to collect all the bees, and spread them on white paper, or put them into water, in a broad, flat-bottomed, shallow, white dish, in which they swim; and by looking at them singly she may be discovered. As the queen breeds the first year she is produced, and the oviducts never entirely subside, an old queen is probably thicker than a new bred one, unless indeed the oviducts and the eggs form in the chrysalis state, as in the silkworm; which I should suppose they did. The queen is perhaps at the smallest size just as she has done breeding; for, as she is to lay eggs by the month of March, she must begin early to fill again; but I believe her oviducts are never emptied, having at all times eggs in them, although but small. She has fat in her belly similar to other bees."

Speaking of the number of queens in a hive, Mr. Hunter says, "I believe a hive, or swarm, has but one queen, at least I have never found more than one in a swarm, or in an old hive in the winter; for, when there are two queens, it is likely that a division may begin to take place. Supernumerary queens are mentioned by Riem, who asserts he has seen them killed by the labourers, as well as the males.

"November 18th, 1788, I killed a hive that had not swarmed the summer before, and which was to appearance ready to swarm every day: but when I supposed the season for swarming was over, and it had not swarmed, I began to suspect that the reason why it did not was owing to there being no

young queen or queens; and I found only one. This is a kind of presumptive proof that I was right in my conjecture; unless it be supposed that, when they were determined not to swarm, they destroyed every queen except one. In a hive that died, I found no males, and only one queen. This circumstance, that so few queens are bred, must arise from the natural security the queen is in from the mode of their society; for, although there is but one queen in a wasp's, horrnet's, and humble bee's nest or hive, yet these breed a great number of queens; the wasp and hornet some hundreds: but not living in society during the winter, they are subject to great destruction; so that probably not one in a hundred lives to breed in the summer."

The *male bees*, of which there are a certain number in every hive, are even larger than the queen, and, of course, considerably superior in size to any of the labourers. These seem to be an indolent set of beings, kept at the expense of the rest of the community, merely to answer the purpose of propagation; for at the beginning of autumn, when the other bees are satisfied there will be neither time nor warmth sufficient to raise another brood, they begin to persecute and expel the drones as useless members of society. This usage the males are obliged tamely to suffer, as they want the sting with which the rest can so ably defend themselves when attacked. When the time is come for this class to turn out, which is generally about the latter end of August or beginning of September, it is to

no purpose for them to be desirous of staying, as they are attacked on all sides, and pushed and dragged about without remorse by their companions, who at length drive them out of the hive. Their aversion even extends to the young drones, who are forced from their cells and sacrificed for the benefit of the commonwealth.

"In 1791," says Mr. Hunter, "as early as the nineteenth of June, I saw the labourers killing the males of a hive, or rather of a swarm, that had not yet swarmed, but was hanging out: this, however, was out of the common course. They appear to be sensible of their fate, for they hurry in and out of the hive as quick as possible, seemingly with a view to avoid the labourers; and we find them attacked by the labourers, who pinch them with their forceps; and when they are so hurt, and fatigued with attempts to make their escape, as not to be able to fly, they are thrown over on the ground and left to die. That this is the fate of every male bee, is easily ascertained by examining every bee in the hive when killed for the honey, which is after this season; no male being then found in it. Bonnet supposes them starved to death, as he never found wounds on them. In the course of a winter I have killed several hives, some as late as April, and in such a way as to preserve every bee; and after examining every one entirely, I never perceived one male of any kind, although it has been asserted there are two sizes of males, and that the small are

preserved through the winter to impregnate the queen."

Of the three sorts of bees which inhabit a hive, it now only remains for us to notice the *labourers*, which are by far the most common, and cannot be said to belong to either sex. These form the populace, and are charged with all the work. There are many thousands of them to one queen, and probably some hundreds to one male. They are supposed to be the only bees that are concerned in constructing the hive and providing the stores. They are busy abroad, and industrious at home; to them, in short, is left the care and management of the whole, while the queen's only concern is to lay her eggs, and the males to walk about and observe the rest. They are smaller than the other bees, and some amongst them are less than others. If we compare them with the queen, a great resemblance will be found to exist; so great indeed, that Mr. Hunter says, "one might suppose that they were only young queens, and that they became queens after a certain age; but this is not the case." Being furnished with stings, and of a very irritable disposition, it is hardly safe to approach too near them, as they will sometimes fly to the attack at once, and, where they are provoked, they always sting. It is a circumstance no less singular than true, that Nature should have provided them with an active means of defence, and yet should have denied them the use of it with impunity. Whenever

one of these insects inserts its sting deeply into any substance, and is in too much haste to withdraw it, the instrument is almost certain to be left behind, and part of the bowels of the bee drawn out with it. Thus it frequently happens that the little animal falls a sacrifice to its revenge.

The trunk of the labouring bee is considerably longer than that of the queen, or the male, and is therefore better adapted to the purpose for which it is designed, viz. extracting the honey from the hollow parts of flowers of considerable depth.

We shall now proceed to examine the body of a bee, which may be divided into three portions; the head, the breast, and the belly. We shall likewise particularly notice the curious apparatus with which it inflicts its wounds.

In the head we perceive two jaws and a trunk; the former of these play like two saws opening and shutting to the right and left; these saws serve them instead of hands, to hold and knead the wax, and to throw away whatever incommodes them. The trunk is a highly curious organ, and is considered as the largest of any animal we know, for its size. It consists of three articulations. The first part is chiefly composed of a horny substance, in which there is a groove; on the end of this is fixed the true trunk, composed of two parts, or articulations. With this little instrument, which is pliant and flexible in the greatest degree, will the bee collect more honey in a day, than we could ever obtain with all our boasted art. With this it probes the

bottoms of the flowers, and robs them of their treasured sweets. The joints in this trunk are admirably adapted to prevent its being injured, by allowing the insect to fold it up when it is not in use: besides this, it is fortified against all accident by four strong scales, two of which closely sheathe it; and the two others, whose cavities and dimensions are larger, encompass the whole. This curious apparatus evidently justifies an observation made by a learned divine, that the minutest things in nature were appointed to some peculiar end and purpose; and that the Deity is as conspicuous in the structure of a fly, as he is in the bright globe of the sun himself.

The middle part or breast of a bee sustains the legs, which are six in number, together with four wings, which serve not only to transport the insect where it pleases, but, by their quick vibrations in the air, occasion the humming noise that informs us of the bee's approach. The hair, which entirely covers the body, is serviceable in retaining the farina which falls from the flowers when they collect the bee bread. At the extremity of the paws two little hooks shaped like sickles may be plainly seen with a moderate magnifier. These hooks are of great use to the bee in many instances; they have two balls of sponge lying immediately under them, by means of which the insect is enabled to adhere to the smoothest surfaces, and walk with ease up a perpendicular pane of glass, or along the ceiling of a room.

The belly of the bee is distinguished into six rings, which the animal can lengthen or contract to a certain degree at pleasure. The inside of this region of the body consists of four parts; the intestines, the bag of honey, the bag of poison, and the sting.

The office of the intestines is to digest the food, in the same manner as this function is performed in all other animals. The bag of honey is as transparent as crystal, and contains the fluid sweets extracted from flowers by the bee; a small portion of which must remain in the bag to nourish the animal, but the largest quantity is discharged into the cells of the magazine, to support the whole community in winter. The bag of poison hangs at the root of the sting, through the cavity of which, as through a pipe, the bee injects this venomous liquor into the wound.

The sting is composed of three parts; the sheath and two darts. The sheath tapers to a very fine point, near which is an opening, calculated to give a free passage to the venom. The two darts are launched through another aperture, and are planted with small sharp points, like the beards of a hook, which rising a little obliquely render the incision more painful, and at the same time prevent the bee from disengaging her sting if she is at all hurried in getting away. It is therefore advisable for the wounded person to remain perfectly quiet, while the bee brings down these lateral points, and closes them round the shaft of the dart; by which means she frequently recovers her weapon, and consi-

derably lessens the pain. The sheath is likewise finely pointed, and makes the first wound, which is succeeded by the injection of the darts and poisonous liquor. Some strong muscles are connected with this sheath, which contribute to its disengagement from the wound; but when it has been plunged too deep, these muscles are torn from the body of the bee, and remain with the sting. The liquor which she at the same time infuses into the wound causes great pain attended with a swelling, which continues several days; but this may be prevented if the sting be immediately drawn out, and the puncture enlarged to give free vent to the venomous matter.

As this is a highly curious subject, we shall add the celebrated Mr. John Hunter's anatomical observations on the sting of the bee. "I have observed," says this gentleman, "that it is only the queen and the labourers that have stings; and this provision of a sting is perhaps as curious a circumstance as any attending the bee, and probably is one of the characters of the bee tribe.

"The apparatus itself is of a very curious construction, fitted for inflicting a wound, and at the same time conveying a poison into that wound. The apparatus consists of two piercers, conducted in a groove, or director, which appears to be itself the sting. This groove is somewhat thick at its base, but terminates in a point; it is articulated to the last scale of the upper side of the abdomen, by thirteen thin scales, six on each side, and one

behind the rectum. These scales enclose, as it were, the rectum or anus all round: they can hardly be said to be articulated to each other, only attached by thin membranes, which allow of a variety of motions: three of them, however, are attached more closely to a round and curved process, which comes from the basis of the groove in which the sting lies, as also to the curved arms of the sting, which spread out externally. The two stings may be said to begin by those two curved processes at their union with the scales, and converging towards the groove at its base, which they enter, then pass along it to its point. They are serrated on their outward edges, near to the point. These two stings can be thrust out beyond the groove, although not far, and they can be drawn within it; and, I believe, can be moved singly.

" All these parts are moved by muscles, which we may suppose are very strong in them, much stronger than in other animals; and these muscles give motion in almost all directions, but more particularly outwards. It is wonderful how deep they will pierce solid bodies with the sting. I have examined the length they have pierced the palm of the hand, which is covered with a thick cuticle: it has often been about the twelfth of an inch. To perform this by mere force, two things are necessary, power of muscles, and strength of the sting; neither of which they seem to possess in sufficient degree. I own I do not understand this operation. I am apt to conceive there is something in it distinct

from simple force applied to one end of a body; for, if this was simply the case, the sting of the bee could not be made to pierce by any power applied to its base, as the least pressure bends it in any direction: it is possible the serrated edges may assist, by cutting their way in like a saw.

"The apparatus for the poison consists of two small ducts, which are the glands that secrete the poison; these two lie in the abdomen, among the air-cells, &c.; they both unite into one, which soon enters into, or forms an oblong bag, like a bladder of urine; at the opposite end of which passes out a duct, which runs towards the angle where the two stings meet; and, entering between the two stings, is continued between them in a groove, which forms a canal by the union of the two stings to this point. There is another duct to the right of that described above, which is not so circumscribed, and contains a thicker matter, which, as far as I have been able to judge, enters along with the other: but it is the first that contains the poison, which is a thin clear fluid. To ascertain which was the poison, I dipped points of needles into both, and pricked the back of the hand; and those punctures that had the fluid from the first described bags in them, grew sore and inflamed, while the others did not. From the stings having serrated edges, it is seldom the bees can disengage them; and they immediately upon stinging endeavour to make their escape, but are generally prevented, as it were caught in their own trap; and the force they use commonly drags

out the whole of their apparatus for stinging, and also part of the bowels; so that the bee most frequently falls a sacrifice immediately upon having effected its purpose."

Removing bees from one place to another, in search of better pasturage for them, has been the custom in some countries for several ages. Pliny alludes to the practice, and says, that when the spring flood for bees has failed in the valleys, it is customary to put the hives into boats and convey them up the river in the night, in search of food. This method, it seems, was practised with success in his time, and is still continued by the Italians who inhabit the banks of the Po. M. Maillet, in his Description of Egypt, observes that the inhabitants of that country send their bees annually to a considerable distance, in order to procure them that sustenance which they cannot obtain at home; and he further tells us that they afterwards bring them back, like shepherds who travel with their flocks, and feed them as they go. The antient inhabitants of Lower Egypt observed that all plants blossomed, and the fruits of the earth ripened, above six weeks earlier in Upper Egypt than with them. This remark was not lost upon them; they applied it to their bees; and the means then made use of, to enable these industrious insects to take advantage of the forward state of nature in those parts, were exactly the same, according to M. Maillet, as are now practised for the same purpose in that

country. This gentleman informs us, that about the end of October, all such inhabitants of the Lower Egypt as have hives of bees embark them on the Nile, and convey them up the river quite into Upper Egypt; observing to time it so that they arrive there just when the inundation is withdrawn, the lands have been sown, and the flowers begin to bud. The hives thus sent are marked and numbered by their respective owners, and placed pyramidically in boats prepared for the purpose. After they have remained some days at their furthest station, and are supposed to have gathered all the wax and honey they could find in the fields within two or three leagues around; their conductors convey them in the same boats two or three leagues lower down, and there leave the industrious insects till they have collected all the riches of this spot. Thus, the nearer they come to the place of their more permanent abode, they find the productions of the earth, and the plants which afford them food, forward in proportion. In fine, about the beginning of February, after having travelled through the whole length of Egypt, gathering all the rich produce of the delightful banks of the Nile, they arrive at the mouth of that river, towards the ocean, from whence they set out, and from whence they are now returned to their several homes; for care is taken to keep an exact register of every district from whence the hives were sent in the beginning of the season, of their numbers,

of the names of the persons who sent them, and likewise of the mark or number of the boat in which they were placed.

Hector St. John, in his Letters, gives a curious account of the method by which he used to discover his lost bees in the woods of America. It appears from his observations, that it is easy to predict the time of their swarming, but very difficult to know, when on the wing, whether they intend to fly to the woods or not. If they have previously agreed to leave the place, and have found some hollow trees to their mind, no art or allurement will induce them to stay. They will prefer the rude habitations they have chosen, to the best polished mahogany hive.

We are assured by this gentleman, that he is certain to retrace his bees, although they may wander eighteen miles from his house, and are lodged in the loftiest trees in the deepest recess of the forest. The plan which he pursues to discover fresh nests will apply equally well to the retracing of his old swarms, and is described by him as follows:

"After I have done sowing, by way of recreation I prepare for a week's jaunt in the woods, not to hunt either the deer or the bears, as my neighbours do, but to catch the more harmless bees. I cannot boast that this chase is so noble or so famous among men; but I find it less fatiguing, and full as profitable; and the last consideration is the only one that moves me. I take with me my dog as a companion, for he is useless as to this game; my

gun, for no man ought to enter the woods without one; my blanket, some provisions, some wax, vermilion, honey, and a small pocket compass. With these implements I proceed to such woods as are at a considerable distance from any settlements. I carefully examine whether they abound with large trees; if so, I make a small fire, on some flat stones, in a convenient place. On the fire I put some wax: close by this fire, on another stone, I drop honey in distinct drops, which I surround with small quantities of vermilion laid on the stone; and then I retire carefully to watch whether any bees appear. If there are any in that neighbourhood, I rest assured that the smell of the burnt wax will unavoidably attract them. They will soon find out the honey; for they are fond of preying on that which is not their own; and, in their approach, they will necessarily tinge themselves with some particles of vermilion, which will adhere long to their bodies. I next fix my compass, to find out their course, which they keep invariably straight, when they are returning home loaded. By the assistance of my watch, I observe how long those are returning which are marked with vermilion. Thus possessed of the course, and, in some measure, of the distance, which I can easily guess at, I follow the first, and seldom fail of coming to the tree where those republics are lodged. I then mark it; and thus, with patience, I have found out sometimes eleven swarms in a season; and it is inconceivable what a quantity of honey these trees will

sometimes afford. It entirely depends on the size of the hollow, as the bees never rest nor swarm till it is replenished; for it is only the want of room that induces them to quit the maternal hive. Next I proceed to some of the nearest settlements, where I procure proper assistance to cut down the trees, get all my prey secured, and then return home with my prize. The first bees I ever procured were thus found in the woods by mere accident; for at that time I had no kind of skill in this method of tracing them. The body of the tree being perfectly sound, they had lodged themselves in the hollow of one of its principal limbs, which I carefully sawed off, and, with a good deal of labour and industry, brought it home, where I fixed it up in the same position in which I found it growing. This was in April. I had five swarms that year, and they have been ever since very prosperous. This business generally takes up a week of my time every fall, and to me it is a week of solitary ease and relaxation."

Besides the domestic bee, whose history we have now concluded, there are several wild species, though none of them are so industrious or frugal as the common sort. Their work is in every particular inferior to these; and although many of their nests are ingenious enough, yet they cannot for a moment be compared with the bee-hive. Their habitations are either composed of dried leaves mixed with wax, or they are formed in the middle of a plank, or other piece of wood, which they perforate

with great labour for the purpose. Among these the carpenter bee, *Apis centuncularis*, merits our attention for the perseverance with which it forms its cell, sometimes in the middle of the most solid kind of wood. These creatures having selected a piece of wood to their mind, which is frequently an upright post, or espalier, begin their operations by boring perpendicularly into it, thus forming a tubular cavity of ten or twelve inches in length, and about the third of an inch in diameter. Weeks are often employed by the insect in completing this business, as she frequently bores three or four of these holes in one piece of wood, where the thickness will admit of it. The dust made by these workmen may be seen in little heaps near the place where they are carrying on their operations. When this tubular dwelling is properly finished, which is not till after the holes are divided into several separate apartments, the animal proceeds to line the whole with rose leaves rolled over each other; and then deposits an egg in each division, carefully closing the apartment, after having provided a sufficient quantity of a paste, composed of the farina of flowers mixed with honey, for the young larva to feed on. This young maggot is so enclosed in the above-mentioned paste when first hatched, that it is obliged to eat itself a space to turn in, and scarcely gets tolerable room in its apartment till most of the food is devoured, and the included animal ready to pass into the chrysalis state. M. Reaumur obtained a piece of wood containing one of the habi-

tations of these insects, and having cut off as much as was sufficient to expose two of the cells to view, in each of which there was a young maggot surrounded with paste, he closed the hole which he had made with a piece of glass, that he might watch their operations without interruption. He observed the two little worms daily increase in size, and the paste with which they were surrounded diminish in the same proportion. In fifteen days they had nearly consumed the whole of their provision, and had grown so large as nearly to fill each cell. In a few days after this, the food was entirely consumed; and they then fasted nearly a week, becoming, during the time, exceedingly agitated, often bending their bodies, and raising and depressing their heads. This is common to many insects before they change into another state, and was observed in this instance, since each maggot shortly became a chrysalis, and in about twenty days afterwards they both were transformed into perfect bees.

It appears that in some seasons this insect is very injurious to the timber, making a vast number of habitations near together, in the substance of healthy oaks, which have been greatly injured by their operations, fifty or sixty tubes lying within a little distance of each other. The bee which forms these curious cavities is of a dusky colour, and covered underneath with a bright ferruginous down. In size it nearly equals the honey bee.

The bee which forms its nest of leaves in the shape of a thimble, is very nearly allied to the above,

if not a variety of the same. There is a wide difference, however, in their manner of proceeding, as this little animal avoids the labour which the other undergoes, and merely makes its nest beneath the surface of the ground. The leaves used by these insects in forming their conical habitations, are generally selected from the rose bush, and they have a way of cutting them which is very singular. Having fixed upon the bush which seems best adapted to their purpose, they begin near the footstalk of the leaf, and cut away, by means of their strong jaws, with great expedition. They always make the incision in a curve line till the leaf is detached: immediately before this happens they prepare themselves for flight, and each bee carries off its leaf in triumph the moment it parts from the stalk.

The anecdote related by M. Reaumur, respecting the nest of this insect, is a strong instance of that superstition which has ever prevailed in the minds of uneducated people, and which sometimes influences those of better understandings. "In the beginning of July 1736, the learned Abbé Nollet, then at Paris, was surprised by a visit from an auditor of the chamber of accounts, whose estate lay at a distant village on the borders of the Seine, a few leagues from Rouen. This gentleman came accompanied, among other domestics, by a gardener, whose face had an air of much concern. He had come to Paris in consequence of having found in his master's ground many rows of leaves, unaccountably disposed in a mystical manner, and which he could

not but believe were there placed by witchcraft, for the secret destruction of his lord and family. He had, after recovering from his first consternation, shown them to the curate of the parish, who was inclined to be of a similar opinion, and advised him without delay to take a journey to Paris, and make his lord acquainted with the circumstance. This gentleman, though not quite so much alarmed as the honest gardener, could not feel himself at perfect ease, and therefore thought it advisable to consult his surgeon upon the business; who, though a man of eminence in his profession, declared himself utterly unacquainted with the nature of what was shown him, but took the liberty of advising that the Abbé Nollet, as a philosopher, should be consulted, whose well-known researches in natural knowledge might perhaps enable him to elucidate the matter. It was in consequence of this advice that the Abbé received the visit above mentioned, and had the satisfaction of relieving all parties from their embarrassment, by showing them several nests formed on a similar plan by other insects, and assuring them that those in their possession were the work of insects also. He opened some of the rose-leaf nests, showed them the inclosed larvæ, and requested permission to send the remainder to M. Reaumur, who pursued their investigation with much eagerness, and soon completed the natural history of the animal."

There is a species of wild bee whose manners differ essentially from the rest, inasmuch as she

builds her nest with a sort of mortar made of earth, which she attaches to the side of a wall, and from this peculiar mode of constructing her habitation she is called the *mason bee*. The whole of the labour and art required in constructing this nest, and which is not a little, falls to the share of the female, who alone has the management of every part of it; and as this bee lives a solitary life, she has no companions to assist her in the task. The outside of this dwelling has a very rude appearance, much like a common lump of dirt; but within it assumes a more regular form, and is divided into a number of cells, nearly of the same size, though varying in number from three to fifteen. These cells, which are nearly an inch high and half an inch in diameter, resemble a thimble in shape, and serve, like those of the other species, for apartments for their young, and storehouses for their future subsistence. The cells, as well as the other parts of the nest, are formed of grains of sand connected together by a glutinous fluid with which the animal is provided; and the whole of the fabric is completed, by the indefatigable exertions of the little female, in the course of a week. These nests, which are soft at first, become as hard as mortar, and, if not molested, will last several years. Notwithstanding the strength of their houses, these bees are not secure from injury, being subject to the visits of an ichneumon fly, which contrives to lay its eggs in their cells; and the consequence is always fatal, as the eggs, after being hatched into

maggots, devour the lawful inhabitants. This is not the only plague; a still more destructive enemy sometimes makes its appearance in the shape of a large grub, that has been deposited in the egg state, in one of the unfinished cells, by a species of beetle, the *Attelabus apiarius*. This creature has no sooner gained a little strength, than with its strong fangs it breaks down all the partitions, and devours every thing it meets with.

There are several other species of wild bees, who are remarkable for their different methods of constructing their nests; but as we have described the most prominent, and have already extended this article to a considerable length, we must refer the reader, who wishes for more information on the subject, to the elaborate publication of Mr. Kirby, entitled *Monographia Apis Angliæ*.

ANT.

GENERIC CHARACTER.

Antennæ filiform.

A little upright scale situated between the thorax and the abdomen.

Sting concealed within the abdomen.

SPECIFIC CHARACTER.

FORMICA RUFA. F. nigra, thorace compresso pedibusque ferrugineis. *Linn. Syst. Nat. Gmel.* 1. p. 2798.
Black, with rusty-coloured feet, and compressed thorax.
Formica thorace compresso toto ferrugineo, capite abdomineque nigris. *Syst. Nat. Linn.* 12. 2. p. 962. no. 3.
FORMICA RUFA. *Scop. Ent. Carn.* 836.
FORMICA FERRUGINEA. *Degeer Ins.* 2. p. 305. no. 1. pl. 14. f. 1, 2.

COMMON ANT. *Schæff. Elem.* pl. 64. *Icon.* pl. 5. f. 3. *Shaw Gen. Zool.* 6. p. 349. pl. 100.

IN describing the manners of this little insect, we only pass from one industrious creature to another. We have left the bee, whose ingenuity is so conspicuous, to describe the ant, who does not fall short in her domestic œconomy, or show less ability

to provide for her young. She is averse to solitude, always living in society; is remarkable for a most industrious spirit; and is offered as a pattern of parsimony to the profuse, and of unremitting diligence to the sluggard.

The sight of ants, says the Abbé La Pluche, is really very instructive. They are a little people, united, like the bees, in a republic governed by its own laws and politics. They have a kind of oblong city, divided into various streets, that terminate at different magazines. Some of the ants consolidate the earth, and prevent its falling in, by a surface of glue with which they incrust it. Those which we commonly see, amass splinters of wood, which they draw over the tops of their streets, and use them as rafters to sustain the roof; and across these they lay another rank of splinters, and cover them with a heap of dry rushes, grass, and straw, which they raise with a double slope, to turn the current of the water from their magazines; some of which are appropriated to receive their provisions, and in the others they deposit their eggs.

It is astonishing to see the persevering industry with which one of these little creatures will drag towards the magazine a mass of provision much larger than itself. It is not to be discouraged by the weight; for if, after having tried the utmost of its powers to accomplish its purpose, it finds the task too great, another will come to its assistance, and thus they will together move the load. A member of the French Academy found a nest of

ants in a box of earth standing out from a window two stories high. From this place they made excursions to the top of the house, where some corn lay in a garret, and into a garden which the window overlooked. The situation of the nest obliged them to go up or down a great way before they could possibly meet with any thing; but he observed, notwithstanding, that none of them returned empty, every one bringing a grain of wheat, rye, or oats, a small seed, or even a particle of dry earth, if nothing else could be got. Some of them travelled to the further end of the garden, from whence they brought very heavy loads, and with great labour succeeded in conveying them to their magazine. The author of this account was amused with the pains these ants took to carry grains of corn up a wall to the second story, climbing all the way with their heads downwards. This retrograde motion must considerably increase the difficulty, and will readily account for the weariness which they all manifested, by stopping at the most convenient places; indeed some were so fatigued and spent that they could not reach their journey's end. When this happened, the strongest ants, which had carried home their load, returned to help them. Sometimes they would fall down with their burdens when just within reach of the nest: but this in nowise discouraged them; they recovered their corn, renewed their efforts, and at length succeeded. The steady perseverance and unwearied patience of one of these ants was remarkable. She had carried a large grain

of wheat with incredible labour up the wall of the house to the box where the nest was, when she and her load together tumbled back to the ground. She was presently observed to recover the shock, and begin to climb again: the second effort met with no better success; she fell as before. This misfortune happened three times successively, without once causing the little animal to quit her hold: her efforts, however, became each time weaker, till at length, being completely exhausted, she was obliged to stop and allow a fellow-labourer to assist her in carrying the precious grain to the public stock.

These industrious insects are not particular in their food, since they will not only eat grain of all sorts, but likewise animal substances. Many of them may frequently be seen at work on the carcase of a large fly, which they will demolish with great expedition. Anatomists sometimes take advantage of this appetite in the ants for animal food, and obtain very admirable skeletons by their assistance, at the same time feasting the community in a sumptuous manner. When the skeleton of a small animal is required, such as a frog, or any creature about that size, the best way is to bury it in a large ant-hill, where the bones are sure to be completely picked, and the remains left in their proper position. Sweets are likewise very acceptable to them; and when they discover a mine of sugar, or any thing equally precious, the whole body proceed in a string to regale upon its contents. Dr. Franklin,

who was too wise a man to think any of the works of the creation beneath his notice, was amused with the œconomy of these little creatures, and tried several experiments to prove that they communicated their thoughts to each other. Among other things, he put a pot of treacle into a closet which was frequented by ants, who collected in considerable numbers, and began to devour its contents: observing this, the doctor shook them out, and suspended the pot by a string which hung from the ceiling: one ant, however, more intent perhaps in feeding than the rest, was left in the pot, and after having satisfied herself attempted to get away, but was unable to reach the ground, as the pot was suspended: she ran round the sides and about the bottom, making many trials, but all in vain: at length she escaped by travelling up the string and along the ceiling, till she reached the wall, and from thence found her way to the ground. In about half an hour after this a swarm of ants were observed to come out, and pass along the ceiling till they came to the string, which they descended regularly, and continued so to do in two columns, one passing down and the other returning, till the whole of the treacle was consumed. This is a pretty strong proof that some communication must pass between them, and that, in this instance, the first ant must have given the intelligence.

After the ants have passed the summer in a constant round of laborious employment, they retire to the inmost recesses of their hill, and there remain

during the cold season in a state of stupor; not, as has been supposed by many, enjoying the fruits of their former industry, but cold and lethargic, waiting the return of the vernal sun to unbend their limbs and renew their activity. After a few days of fine warm weather the whole body is again in motion, and the females soon begin to lay their eggs, which are carefully attended to and placed in the most secure part of the hill. It has been erroneously supposed, that the small oval bodies which the ants carry with so much care from place to place, when they are disturbed, are the eggs. On the contrary, the eggs themselves are so very small as hardly to be visible; even the maggot, when first hatched, is not much larger than a common grain of sand. It increases, however, progressively in size, till the time appointed for its passage into the chrysalis state, when it spins itself a silken web and becomes the little oval body already noticed, and about which the parent shows so much solicitude. To be convinced of the great attachment of ants to their young, it is only necessary to disturb one of their hills with a stick, and the community will be immediately seen in the greatest confusion; every one is busy, but none forgets its charge, and the first object of their care seems these oval bodies, which they seize with one accord; and such is their assiduity, that although hundreds strew the ground in every direction about the hill, they will all be removed to a place of safety in a few minutes. In proportion as the season is moist or

dry, these aurelias are raised towards the surface of the hill, or carried to a depth below: even at the approach of night, or when there is an appearance of showers, will these industrious insects convey their charge to a place of safety, where neither cold nor wet can molest them. Swammerdam kept several working ants, with their young, in a glass filled with earth, and was pleased to observe, that, as the earth dried on the surface, they dug deeper and deeper to deposit their eggs. When he poured water on them the parents laboured with unremitting diligence to put the young brood in the driest place, and did not cease to labour till they had effected their purpose.

The males and females may be observed in the nests about the end of July or beginning of August; they differ from the neuters in having wings, and the female may be at once distinguished by her size, which is much larger than the male. These last, having no longer any occupation at home, fly to a distance from the nest, and return no more; they are said to live but a short time after the breeding season, many of them perishing by cold, and more by the smaller kinds of birds which devour great numbers of them. The females likewise emigrate with them; but then they return again to their nests, and once more attend to their domestic œconomy,

Our European ants, though sometimes sufficiently troublesome, are not to be compared with the species inhabiting the warmer parts of the world,

which frequently commit incredible ravages, and sting with great severity. The damage done in the West Indies about forty years ago by the sugar ant, *Formica saccharivora* Linn., almost exceeds belief. From the account in the thirtieth volume of the Philosophical Transactions, we learn that this pest first made its appearance on a sugar plantation at Petit Havre, in the Island of Grenada, and afterwards extended to the distance of twelve miles from this spot, destroying every sugar plantation in the way. Every attempt that was made by the planters to put a stop to these destructive insects proved ineffectual: and such was the general consternation at their ravages, that a reward of twenty thousand pounds was offered to that person who should discover an effectual remedy for the evil. So large a sum, secured to the successful candidate by an act passed for the purpose, induced many to try their utmost to destroy the ants; and all succeeded partially; but none gained the prize, since the destruction of one myriad availed nothing, their place being immediately filled by another. Charcoal taken from the fire, and laid in quantities in their way, proved very destructive; they crowded upon it with the greatest eagerness, and thus were burnt to death: but their numbers were so excessive that they soon extinguished it; and although wherever the charcoal was laid the dead ants formed from their numbers a little hillock, yet their army did not appear to be diminished. The roads were literally covered with them for miles together; so

that the print of a horse's foot, in passing through them, was covered in a moment by the surrounding multitude.

The inhabitants of the island were at length relieved from this calamity by another, which, although very disastrous in its effects, they were more used to, and therefore less disturbed about. This was a hurricane, which came with its usual violence, and not only tore trees and sugar-canes up by the roots, but destroyed the nests of these insects; and it is probable that the ants perished in the deluge of rain which succeeded.

These ants make their nests at the roots of the sugar-canes, which are so much injured by them that the proper circulation of the sap is cut off; consequently the plants become sickly, and incapable of yielding any tolerable quantity of sugar.

In Hawksworth's account of Cook's first voyage, there is a description of three different species of ants found in New South Wales. As these little animals were noticed by an actual observer, and afford some curious information, we shall subjoin the account in his own words:

"Some are as green as a leaf, and live upon trees, where they build their nests of various sizes, between that of a man's head and his fist. These nests are of a very curious structure: they are formed by bending down several of the leaves, each of which is as broad as a man's hand, and glueing the points of them together, so as to form a purse. The viscous matter used for this purpose is an ani-

mal juice which Nature has enabled them to elaborate. Their method of first bending down the leaves we had no opportunity to observe; but we saw thousands uniting all their strength to hold them in this position, while other busy multitudes were employed within, in applying this gluten that was to prevent their returning back. To satisfy ourselves that the leaves were bent and held down by the effort of these diminutive artificers, we disturbed them in their work; and as soon as they were driven from their station, the leaves on which they were employed sprang up with a force much greater than we could have thought them able to conquer by any combination of their strength. But though we gratified our curiosity at their expense, the injury did not go unrevenged; for thousands immediately threw themselves upon us, and gave us intolerable pain with their stings, especially those which took possession of our necks and hair, from whence they were not easily driven. Their sting was scarcely less painful than that of the bee; but, except it was repeated, the pain did not last more than a minute.

"Another sort are quite black, and their operations and manner of life are not less extraordinary. Their habitations are the inside of the branches of a tree, which they contrive to excavate by working out the pith almost to the extremity of the slenderest twig; the tree at the same time flourishing as if it had no such inmate. When we first found the tree, we gathered some of the branches, and were scarcely

less astonished than we should have been to find that we had profaned a consecrated grove, where every tree upon being wounded gave signs of life; for we were instantly covered with legions of these animals, swarming from every bough, and inflicting their stings with incessant violence.

"A third kind we found nested in the root of a plant which grows on the bark of trees in the manner of mistletoe, and which they had perforated for that use. The root is commonly as big as a large turnip, and sometimes much bigger: when we cut it, we found it intersected by innumerable winding passages, all filled with these animals, by which, however, the vegetation of the plant did not appear to have suffered any injury. We never cut one of these roots that was not inhabited, though some were not bigger than a hazle-nut. The animals themselves are very small, not more than half as big as the common red ant in England. They had stings, but scarcely force enough to make them felt: they had, however, a power of tormenting us in an equal if not in a greater degree; for, the moment we handled the root, they swarmed from innumerable holes, and, running about those parts of the body that were uncovered, produced a titillation more intolerable than pain, except it is increased to great violence."

In South America these insects are equally common, and some of them grow to a large size. Dampier observed two or three sorts of black ants which were very formidable; he describes one of them,

the great black ant, as exceedingly venomous, and tells us that it stings or bites almost as bad as a scorpion. Another kind, of a yellow colour, is scarcely less to be dreaded; since they cover the trees in every direction, and fall from the boughs upon the passing traveller before he is aware of the mischief. The nests of this species are placed between the limbs of great trees, and, if we may credit Dampier, are, some of them, as large as a hogshead. These are their winter habitations, to which they retire as soon as the autumnal rains commence; but in the dry season they leave their nests, and swarm all over the woodlands, where their method of travelling in a line has worn extensive paths of three or four inches broad. They bring home heavy burthens on their backs, but all their loads seem to consist of the same substance, and of equal size. Dampier assures us he never saw them return with any thing but pieces of green leaves, and these of such a size as to cover the body of the labouring insect, who, nevertheless, pressed forward with vigour, followed by a host of companions with their leaves upon their shoulders, so that the path looked perfectly green, and gave to the whole a very pleasing effect.

DIPTEROUS INSECTS.

GAD-FLY.

GENERIC CHARACTER.

Antennæ short; setaceous.

Mouth none; but in its place three small impressed points are found, without any visible proboscis or rostrum.

SPECIFIC CHARACTER.

ŒSTRUS BOVIS. Œ. alis immaculatis, abdomine nigro; basi albo apiceque fulvo. *Linn. Syst. Nat. Gmel.* 1. p. 2809.

Wings without spots; a black band crosses the abdomen, which is white at the base, and tawny at the tip.

Œstrus alis immaculatis, thorace nigro; scutello pallido, abdomine nigro; basi albo apiceque fulvo. *Syst. Nat.* xii. 2. p. 970. no. 4.

OX GAD-FLY. . *Reaum. Ins.* 4. pl. 38. f. 7, 8. *Degeer Ins.* 6. p. 297. no. 2. pl. 15. f. 22. *Linn. Trans.* 3. p. 291. pl. 23. f. 1, 2, 3, 4, 5, 6. *Shaw Gen. Zool.* 6. p. 358. pl. 102.

THESE flies are so much dreaded by our cattle, that the moment they see one of them in the air the

whole herd will run away in the greatest consternation, and escape, if possible, into some water, where they are secure from its attacks. This precaution seems implanted in them by Nature; as young and old, those who have suffered from the enemy and those who have not, fly equally to the only place of refuge afforded them. Their fears are not without foundation, since these flies are constantly upon the watch to deposit their eggs in the backs of the cattle; and they are provided with a very curious instrument for this purpose. It consists of a cylindrical tube, composed of four pieces which draw out from the posterior part of the animal like the same contrivance in a pocket telescope. The last of these pieces is armed with three hooks, and acts as a gimlet to bore through the tough hide, in order to make a hole for the egg which is to follow. This operation is performed by the female gad-fly in a few seconds, and is generally repeated on several parts of the animal's back. Mr. Bracy Clark, whose observations on this genus of insects do him so much credit, says, that this species in particular inflicts the most pain while laying its eggs. The unfortunate beast who is attacked by one of these plagues may be readily distinguished by his agitation. He feels the wound, is conscious of its consequences, and in extreme terror runs bellowing from the rest of the herd to a distant part of the heath, or the nearest water; while the tail, from the severity of the pain, is held with a tremulous motion straight from the body, in

the direction of the spine, and the head and neck are also stretched out to the utmost. The horror excited by these insects in cattle is so great that nothing will prevent their efforts to escape from them. This is well known to those farmers who employ oxen to plough their lands, many of them having a contrivance to set the beasts at liberty the moment they are bitten: where this precaution is neglected, unpleasant consequences sometimes ensue; as the oxen become quite furious upon these occasions, and will frequently run with the plough directly forwards, through hedges, or whatever obstructs their way.

We have already noticed that each puncture made by the gad-fly is followed by an egg, which after a time is hatched in the back of the animal, and the larva, by the irritation it produces, causes a swelling in the part, which terminates in a small abscess open at the top. The young maggot is imbedded in the fluid of this abscess, where it continues all the winter, and in the following June forces its way through the opening, and, falling from the back of the animal to the ground, becomes a chrysalis. At this time, we are told, the maggot is in great danger of being destroyed; for if it falls on land it is frequently trodden upon, or picked up by birds; if it falls in the water, where the cattle stand during most of the day in the summer season, its fate is certainly decided, as it either perishes, or becomes the food of fishes. After the larva is excluded, the sore upon the back of the animal soon heals.

From about the middle of June till the same time in August the insect continues in the form of a chrysalis, when the fly arrives at its last and perfect state, and escapes from its shell by opening a very singular triangular lid, which, according to the observation of Mr. Clark, may be traced in the skin of the larva, and is situated on the side of the small end. The ox gad-fly is the largest of the European species, and is very beautiful.

Heifers, steers, and younger cattle are said to be most frequently attacked by this gad-fly, and to have in general a greater number of *bots*, as they are called, than others: as the insects always select the strongest and most healthy of the beasts to lay their eggs in, the number of their marks in a hide has become a criterion of goodness in much esteem with the dealers in cattle. The tanners likewise are aware of this fact, and observe that the best and strongest hides have the greatest number of bot-holes in them.

The care and attention which is paid to that noble and valuable animal the horse, has caused, perhaps, more inquiry to be made into the natural history of the kind of bot that infests his intestines, than if the same insect had inhabited the bowels of any creature of inferior note. This troublesome maggot derives its being from another species of the same genus, the *Œstrus equi*, or horse gad-fly, the history of whose introduction into, and passage through, the alimentary canal of the horse, has

been accurately related by the ingenious Mr. Bracy Clark, from whose paper we have taken the liberty to extract the following particulars:

"When the female has been impregnated, and the eggs are sufficiently mature, she seeks among the horses a subject for her purpose; and approaching it on the wing, she holds her body nearly upright in the air, and her tail, which is lengthened for the purpose, curved inwards and upwards: in this way she approaches the part where she designs to deposit her egg; and, suspending herself for a few seconds before it, suddenly darts upon it, and leaves her egg adhering to the hair: she hardly appears to settle, but merely touches the hair with the egg held out on the projected point of the abdomen. The egg is made to adhere by means of a glutinous liquor secreted with it. She then leaves the horse at a small distance, and prepares a second egg, and, poising herself before the part, deposits it in the same way. The liquor dries, and the egg becomes firmly glued to the hair: this is repeated by various flies, till four or five hundred eggs are sometimes placed on one horse. The horses, when they become used to this fly, and find that it does them no injury, as the *Tabani* and *Conopes*, by sucking their blood, hardly regard it, and do not appear at all aware of its insidious object. The skin of the horse is always thrown into a tremulous motion on the touch of this insect, which merely arises from the very great irritability of the skin and cu-

taneous muscles at this season of the year *, occasioned by the continual teasing of the flies, till at length these muscles act involuntarily on the slightest touch of any body whatever.

" The inside of the knee is the part on which these flies are most fond of depositing their eggs, and next to this on the side and back part of the shoulder, and, less frequently, on the extreme ends of the mane. But it is a fact worthy of attention, that the fly does not place them promiscuously about the body, but constantly on those parts which are most liable to be licked with the tongue; and the ova, therefore, are always scrupulously placed within its reach.

" The eggs thus deposited I at first supposed were loosened from the hairs by the moisture of the tongue, aided by its roughness, and were conveyed to the stomach, where they were hatched: but on more minute search I do not find this to be the case, or at least only by accident; for, when they have remained on the hairs four or five days, they become ripe, after which time the slightest application of warmth and moisture is sufficient to bring forth in an instant the latent larva. At this time, if the tongue of the horse touches the egg, its operculum is thrown open, and a small active worm is produced, which readily adheres to the moist surface of the tongue, and is from thence conveyed with the food to the stomach. If the egg itself be

* August and part of September.

taken up by accident, it may pass on to the intestinal canal before it hatches; in which case its existence to the full growth is more precarious, and certainly not so agreeable, as it is exposed to the bitterness of the bile.

" I have often with a pair of scissars clipped off some hairs with eggs on them from the horse, and on placing them in the hand, moistened with saliva, they have hatched in a few seconds. At other times, when not perfectly ripe, the larva would not appear, though held in the hand under the same circumstances, for several hours; a sufficient proof that the eggs themselves are not conveyed to the stomach. It is fortunate for the animal infested by these insects that their numbers are limited by the hazards they are exposed to. I should suspect near a hundred are lost for one that arrives at the perfect state of a fly. The eggs, in the first place, when ripe, often hatch of themselves, and the larva, without a nidus, crawls about till it dies; others are washed off by the water, or are hatched by the sun and moisture, thus supplied together. When in the mouth of the animal, they have the dreadful ordeal of the teeth and mastication to pass through. On their arrival at the stomach, they may pass mixed with the mass of food, into the intestines; and when full grown, in dropping from the animal to the ground, a dirty road or water may receive them. If on the commons, they are in danger of being crushed to death, or of being picked up by the birds who so constantly attend the foot-steps of

the cattle for food. Such are the contingencies by which Nature has wisely prevented the too great increase of their numbers, and the total destruction of the animals they feed on.

" I have once seen the larva of this œstrus in the stomach of an ass; indeed there is little reason to doubt their existence in the stomachs of all this tribe of animals. These larvæ attach themselves to every part of the stomach, but are generally most numerous about the pylorus, and are sometimes, though much less frequently, found in the intestines. Their numbers in the stomach are very various, often not more than half a dozen, at other times more than a hundred, and, if some accounts might be relied on, even a much greater number than this. They hang most commonly in clusters, being fixed by the small end to the inner membrane of the stomach, which they adhere to by means of two small hooks or tentacula. When they are removed from the stomach they will attach themselves to any loose membrane, and even to the skin of the hand. The body of the larva is composed of eleven segments, all of which, except the two last, are surrounded with a double row of horny bristles directed towards the truncated end, and are of a reddish colour, except the points, which are black. The larvæ evidently receive their food at the small end, by a longitudinal aperture, which is situated between two hooks or tentacula. Their food is probably the chyle, which, being nearly pure aliment, may go wholly to the com-

position of their bodies without any excrementitious residue, though on dissection the intestine is found to contain a yellow or greenish matter, which is derived from the colour of the food, and shows that the chyle, as they receive it, is not perfectly pure. They attain their full growth about the latter end of May, and are coming from the horse from this time to the latter end of June, or sometimes later. On dropping to the ground they find out some convenient retreat, and change to the chrysalis; and in about six or seven weeks the fly appears.

" The perfect fly but ill sustains the changes of weather; and cold and moisture, in any considerable degree, would probably be fatal to it. These flies never pursue the horse into the water. This aversion I imagine arises from the chillness of that element, which is probably felt more exquisitely by them, from the high temperature they had been exposed to during their larva state. The heat of the stomach of the horse is much greater than that of the warmest climate, being about 102 degrees of Fahrenheit, and in their fly state they are only exposed to 60, and from that to about 80 degrees. This change, if suddenly applied, would in all probability be fatal to them; but they are prepared for it, by suffering its first effects in the quiescent and less sensible state of a chrysalis. I have often seen this fly during the night-time, and in cold weather, fold itself up with the head and tail nearly in contact, and lying apparently in a torpid state, through the middle of the summer."

The different species of this genus make their attack on different animals, and each proceeds to deposit its ova in some particular part of the beast: while one pierces the hide, another lays its egg in the hair, and a third introduces them into the nostrils of the terrified animal. This last, or *Œstrus ovis*, is the torment of the sheep; for, the moment it approaches, the whole flock become extremely agitated, shaking their heads, and striking their fore-feet violently against the ground. Conscious of the dreadful consequences of an attack, they endeavour to avoid their enemy by holding their noses close to the earth, and running in every direction about the common. As they go along, they smell to the grass lest one of their tormentors should be lying in wait for them, and as soon as possible remove to the dusty road, or a neighbouring gravel-pit, where they crowd together with their noses so close to the ground that the fly is unable to get at them. If the sheep are driven from this, they retreat to the grass: in the heat of the day the fly will be frequently seen to attack them, and the whole flock will be thrown into confusion. These poor animals have sufficient reason for their fears; since the larvæ hatched within their nostrils produce a degree of inflammation, and consequently pain, that only ceases when the bots fall to the ground preparatory to their passage into the state of a chrysalis.

The other species of this genus contain nothing particularly deserving of notice, unless, according to

the opinion of a learned naturalist, Dr. Shaw, we may place the *zimb* of Mr. Bruce among the number. This gentleman, however, does not pretend to determine whether it ought to be referred to this genus or not; he was only led to suppose so from some particulars in its history which corresponded with the other species. The insect has long been a wanderer; no one has decided its place in the system, and the present attempt to fix its situation may possibly be rejected by future entomologists.

Mr. Bruce, who had several opportunities of observing this fly during his residence in Abyssinia, has described it in the following manner: "It is in size very little larger than a bee, and its wings, which are broader than those of a bee, placed separate, like those of a fly; they are of pure gauze, without colour or spot upon them; the head is large, the upper jaw or lip is sharp, and has at the end of it a strong pointed hair of about a quarter of an inch long: the lower jaw has two of these pointed hairs; and this pencil of hairs, when joined together, makes a resistance to the finger nearly equal to that of a strong hog's bristle. Its legs are serrated in the inside, and the whole covered with brown hair or down. As soon as this plague appears, and their buzzing is heard, all the cattle forsake their food, and run wildly about the plain till they die, worn out with fatigue, fright, and hunger. No remedy remains for the residents on such spots, but to leave the black earth and hasten down to the sands of Atbara; and there they remain while the rains last,

this cruel enemy never daring to pursue them further."

The zimb does not appear, like the ox gad-fly, to confine its attacks to the cattle, but becomes a general scourge, and inflicts its wounds on the camel, the rhinoceros, and even the elephant, who suffer in proportion to the sensibility of their skins. The camel, when once attacked by this fly, must immediately remove to the sands of Atbara; for every puncture which the zimb makes in his hide is followed by swelling, inflammation, and abscess; his head, body, and legs, break out in large tumours, which discharge, and sometimes mortify, to the certain destruction of the creature. The elephant and rhinoceros are better enabled to withstand the attacks of this formidable insect, on account of their thick skins; but even these enormous creatures think it expedient to roll themselves at times in the mud, that they may thus form an artificial coat in addition to their natural one.

"All the inhabitants of the sea-coast of Melinda," says Mr. Bruce, "down to Cape Gardefan, to Saba, and the south of the Red Sea, are obliged to put themselves in motion and remove to the next sand in the beginning of the rainy season, to prevent all their stock of cattle from being destroyed. This is not a partial emigration; the inhabitants of all the countries from the mountains of Abyssinia northward, to the confluence of the Nile and Astaboras, are once a year obliged to change their abode, and seek protection in the sands of Beja; nor is there

any alternative, or means of avoiding this, though a hostile band was in their way, capable of spoiling them of half their substance."

These insects are said by Mr. Bruce to inhabit only one species of soil, which is a black fat earth, of extraordinary fertility, which seems from the first to have given a law to the settlement of the country, as it deprived those inhabitants of the fat earth called mazaga, brought up in caves and mountains, from enjoying the assistance of any beasts of carriage. "It deprived them of their flesh and milk for food, and gave rise to another nation whose manners were just the reverse of the first. These were the shepherds, leading a wandering life, and preserving these immense herds of cattle by conducting them into the sands beyond the limits of the black earth, and bringing them back again when the danger from the insect was over."

The jarring noise which the zimb makes in its flight, is supposed by Mr. Bruce to proceed partly from the vibration of the three hairs at the snout: he observes that it flies with more rapidity than the bee, and that its motion resembles that of the English gad-fly. In its manners it certainly bears a strong resemblance to that insect, and appears to deserve a place in the same genus.

FLY.

GENERIC CHARACTER.

Antennæ short.

Mouth formed by a soft fleshy proboscis, with two lateral lips.

SPECIFIC CHARACTER.

MUSCA PENDULA. M. thorace lineis quatuor, abdomine fasciis tribus interruptis flavis. *Linn. Syst. Nat. Gmel.* 1. p. 2868.

Four lines on the thorax; three irregular yellow bands across the abdomen.

PENDULOUS FLY. *Reaum. Ins.* 4. pl. 31. f. 9. 11. *Frisch. Ins.* 4. pl. 13. *Shaw Gen. Zool.* 6. p. 382. pl. 105.

THE larva of this fly exhibits a striking example of contrivance adapted to a visible end, and such an one, indeed, as could *alone* ensure the life of an animal, which is destined to seek its food at the bottom of the water, and yet obliged to breathe from the surface at the same time.

The celebrated French entomologist, M. Reaumur, very properly called this animal *Queue de rat*, from the length of its tail, which is of a singu-

lar conformation, and is in fact the instrument through which the creature respires. The surface of the water which these insects inhabit appears to be in perpetual motion, where there are many of them near together; and as they are generally found in muddy places, it becomes necessary to remove them from hence, in order to observe their movements in a satisfactory manner. Their bodies are about half an inch long, and their tails an inch. If some of them are put into a glass vessel of clear water, filled in proportion to their measure, they will soon become settled with their heads at the bottom, and the end of their tails just above the surface. In this there is nothing particular or extraordinary; but upon adding more water a wonderful contrivance is manifested; the tail is immediately lengthened in proportion to the height of the water in the vessels, and proves to be a mere tube, containing within it another much smaller, which the animal is enabled to shoot out whenever it has occasion to seek a greater depth. In order to determine how far these insects could extend their tails, Reaumur collected a few of them, which he placed in a proper vessel, and found that upon adding water gradually the tails still kept above the surface, till the depth amounted to between five and six inches. Here their extensive power seemed to cease, and they were obliged, upon more water being added, to leave the bottom, and either keep higher in the water, or attach themselves to the sides of the vessel, so that the extremity of their tubular tails might still be

in the air. Thus do these little creatures contrive to make two elements contribute to their welfare at the same moment.

These larvæ after a certain time pass through a second state, and become very beautiful flies, with four longitudinal black lines upon a bright yellow thorax. These flies lay their eggs close to the water, and in a situation where they are constantly supplied with a sufficient degree of moisture, without being removed from the influence of the sun. Here they are hatched; and the young, immediately upon their exclusion, enter that element in which they are destined to pass so great a share of their lives.

The Musca pendula is a curious example of a very extensive genus, containing no less, according to Gmelin, than three hundred and eighty-seven species. This vast tribe ranks very low in the scale of animated beings, and yet each individual contains parts which are worthy of observation. The common fly will serve as well as any, to prove that Nature has not been deficient in providing these apparently insignificant creatures with every requisite for their existence during the short time they are allowed to live. Weak and contemptible as we may think this insect, it is furnished with parts that are highly curious, and only require the assistance of a microscope to raise our admiration of what we before looked upon with contempt. It has excellent eyes; it has antennæ or horns, wings, claws, sponges, and a trunk.

The eyes, like those of beetles and dragon-flies, are constructed in a very peculiar manner. They are two little hemispheres, perfectly immoveable, and occupying a large portion of the insect's head. Each of these hemispheres contains a prodigious number of minute eyes arranged in a regular order by the side of each other, so that the whole assemblage appears like lattice-work. Each of these minute specks is a perfect eye, and may be plainly seen when properly magnified by a compound microscope. By this contrivance the fly is enabled to see on all sides. The eyes of other creatures (if we may use the expression) are multiplied by motion; whereas those of a fly are fixed and immoveable, consequently without this arrangement the animal could only see in one direction; as it is, she is enabled to see every thing in which she can be interested. She has a number of enemies, but she has more than an eye for each, and can discover whatever danger threatens her from above, behind, or on either side, even when she is in full pursuit of a prey directly before her.

We observe seven or eight articulations in the leg of a fly, besides two bending claws, and several minute points on each of its paws: above all, we ought to notice the singular little sponges at the bottom of the feet placed at the juncture of its claws. Naturalists have supposed that, when this animal marches over any polished body on which neither her claws nor points can fasten, she sometimes compresses her sponge, and causes it to eva-

cuate a fluid, which fixes her in such a manner as prevents her falling, without diminishing the facility of her progress. By some these sponges have been thought to correspond with the fleshy balls which accompany the claws of dogs and cats; and that they enable the fly to proceed with a softer pace, and contribute to the preservation of its claws, whose pointed extremities would be soon impaired without this prevention. Besides these sponges her paws are shaded with a growth of hair, which she employs instead of a brush to clean her wings and eyes. If she is noticed at this employment, she will be seen first to clean her brushes, by rubbing one paw against the other, after which she draws them first over her wings and then under, concluding the whole with brushing her head; and this operation she is obliged frequently to repeat in order to clear herself of dust, which if neglected would accumulate, and injure her delicate frame.

The trunk is composed of two parts, one of which folds over the other, and both of them are sheathed in the mouth. The extremity of this trunk is sharp like a knife, to enable the fly to cut what she eats. She likewise forms it into two lips, that she may the better take up proper quantities of food; and when she has occasion, she employs it as a pump for drawing up liquors.

GNAT.

GENERIC CHARACTER.

Antennæ filiform.

Mouth formed by a flexible sheath, enclosing setæ, or bristles, pointed like stings.

SPECIFIC CHARACTER.

CULEX PIPIENS. C. cinereus, abdomine annulis fuscis octo. *Linn. Syst. Nat. Gmel.* 1. p. 2886.

Ash-coloured, with eight brown rings on the abdomen.

β. MUSQUITOES. *Kalm. It.* 2. p. 268.

COMMON GNAT. *Reaum. Ins.* 4. pl. 43, 44. *Geoff. Ins.* 2. p. 579. pl. 19. f. 4. *Roes. Ins.* 3. pl. 15. *Shaw Gen. Zool.* 6. p. 388. pl. 109.

THE gnat, like most other insects, passes through three different states, two of which are spent in the water, the other in the air. The larvæ are those little insects which are so common in the month of May, in almost every stagnant water, and which may be frequently seen in our water-butts with their heads downwards and their tails just above the surface: in this situation they continue quiet till any thing alarms them; when they immediately

descend to the bottom, but are quickly obliged to return again to the surface in order to breathe, which they effect through a tubular orifice in the tail. The eggs from whence these insects proceed, are deposited by the parent animal in groups of several hundreds, enclosed in an unctuous matter, and placed on the surface of the water, and almost constantly in the vicinity of some aquatic plant. When the larvæ have been nearly a month excluded from the egg, during which time they feed on the minute animal and vegetable substances which abound in stagnant waters, they begin to change their form and turn into chrysalids. In this state they appear rolled up, except a portion of the tail which hangs down; the upper part has a very uncouth appearance, and the rudiments of the future insect may be traced through the thin covering. The situation of the respiratory organs is completely changed; for, whereas in the larva the tail was the medium through which the animal breathed, in the chrysalis the same function is performed near the head; a difference is likewise perceptible in the means, the larva breathing through one tube, while the chrysalis respires through two.

From this state the gnat is transferred to another element, and becomes an inhabitant of a new world. In order to effect this change she struggles to break through her prison, bursts the chrysalis, and, resigning the empty shell of the amphibious animal, springs into the air with a body actuated by a surprising agility, and with limbs of the finest texture.

The head is decorated with a beautiful plumage, and the body covered with scales and hair, which at once defend her from humidity and cold.

But the most curious part about this little creature, and that which constitutes the only inconvenience we receive from it, is the trunk, which is well calculated to excite our admiration. It is wonderfully formed, and at the same time so minute that it requires an excellent microscope to give us a just view of its extremity. The trunk consists of a case composed of long scales, which the gnat carries under her throat; from an opening in which, at about the distance of two-thirds of its extent, she lanches four darts, and then returns them into her quiver; one of these darts, pointed and active as it is, performs the office of a new case to the other three, which have their sides sharpened in the most exquisite manner, and barbed towards the point, which is a little hooked and of inexpressible fineness. These spiculæ, or stings, are darted at once into the flesh of the animal whose blood they mean to regale on; and the wounds which they make, together with a small quantity of liquor which they are said to inject in the place at the same time, cause the inflammation and itching which are so generally complained of by those who are gnat-bitten. When the insect has made her orifice, she sucks the blood through her trunk, and, if undisturbed, will continue her sanguinary employment till she swells from repletion, and has completely gorged herself.

It is only when she meets with flesh which resists her efforts, that she employs her pointed weapons; at other times, when she has only soft fruits or juices for a repast, she merely inserts the extremity of her trunk, and sucks the liquor through the tube. The observation of Reaumur, that of the many millions of these insects which swarm in the marshy places where they are bred, perhaps not one in a thousand can taste of blood in its life, is very just; and therefore we must conclude that they were designed to live more on vegetable than animal juices.

With such an instrument to extract the nutriment from every substance which may be the object of her choice, the gnat passes the summer in the greatest gaiety; but as soon as winter approaches she loses her activity, the little sting is less and less employed, till at length she is released from the care of obtaining provisions, entirely ceases to eat, and passes the cold days and dreary nights of that melancholy season in caves and holes, where she can be sheltered till the spring calls her forth to accomplish the most important duty of her life, the perpetuating of her family. For this purpose she flies in quest of the first standing water, on which she deposits her eggs in the manner already explained, and the little progeny arising from these are sometimes so numerous that the water which contains them seems completely animated.

In the warmth of summer, when, for the sake of the little air which is to be obtained, we are in-

duced to sleep with our windows open, these insects prove troublesome by humming about our beds and raising our fears lest we should be bitten in the night; but how trifling, how insignificant, is the cause of this fear when compared with the variety which infests other climates, and is known by the name of the *musqueto!* This indeed is justly dreaded by the inhabitants, as hardly any precaution seems sufficient to defend them from its attacks, or any means effectual to exclude it from their dwellings. Smoke has been found the best material to drive them to a distance; but then the remedy is nearly as bad as the disease, since it is almost necessary to choke yourself in order to succeed by this method. The poor Laplander, whose summer is of so short a duration, is tormented beyond measure by this plague. Swarms innumerable are brought to life by the sun's influence on the marshy tracts of that dreary country; and these, insinuating themselves into every hut, deprive the inhabitants of the little comfort their wretched dwellings afford. The cattle are far from escaping their share of the torment; and the rein-deer are rendered so uneasy by these flies, that, while one person is employed in milking them, another is obliged to hold a firebrand close to the animal, that the musquetoes may be kept at a distance. This ability to do mischief seems confined to the female, who alone is capable of making a wound and sucking the blood from it. The puncture is succeeded by violent itching, the part swells, and the skin sometimes blisters and

forms a sore. Those who enter the woods without defending their face and hands from their attacks, are immediately covered and tormented by them beyond description; they crowd on every part, and inflict their stings without mercy, so that the faces of the persons on their return are so disfigured as hardly to be known. This description, to those unacquainted with the effects of these insects, may appear like romancing; but the traveller who has visited the West Indies, or any of those climates infested with this plague, will testify as much, and readily acknowledge that he has been more afraid of a few of these little creatures than of a host of larger animals. Musqueto curtains of a fine texture are used to defend the sleeper in the more civilized parts of the world, while the simple Laplander is obliged to be content with a less costly contrivance: he fixes a leather thong to the poles which support his tent, and with this he raises his canvass quilt to a proper height, so that its sides touch the ground; then creeping under the shelter which it affords him, he contrives to pass the night in tolerable security.

This variety is rather larger than the common gnat, and is the pest of all hot climates, as well as of those near the poles, where the summer is but of short duration, but where the sun for a season never sets.

APTEROUS INSECTS.

WHITE ANTS.

GENERIC CHARACTER.

Antennæ moniliform.
Mouth armed with two strong jaws.

SPECIFIC CHARACTER.

TERMES FATALE. T. supra fuscum, thorace segmentis tribus, alis pallidis: costa testacea. *Linn. Syst. Nat. Gmel.* 1. p. 2911.

Colour brown, thorax divided into three segments, wings pale; side testaceous.

Termes luteum, alterius maxillis longitudine antennarum (larva et pupa). *Syst. Nat.* xii. 2. p. 1015. no. 1.

TERMES ARDA. *Forsk. Fn. Arab.* p. 96. no. 61. pl. 25. f. A.

TERMES DESTRUCTOR. *Degeer Ins.* 7. p. 50. no. 3. pl. 37. f. 1, 2.

TERMES BELLICOSUS. *Smeath. Act. Angl.* v. 71. part 1. p. 141.

WHITE ANT. . *Phil. Trans.* vol. 71. part 1. p. 141. *Shaw Gen. Zool.* 6. 414. pl. 118.

THE wonderful œconomy of the little white ant is so truly deserving of notice, that we cannot be too particular in the description of its manners. The very interesting paper by Mr. Smeathman, inserted in the seventy-first volume of the Philosophical Transactions, contains a full account of the proceedings of this little creature, which, uniting with others of the same species, forms a republic regulated by its own laws: but as the mere reference to this extensive work, which is too costly to become general, will be of little use, we shall avail ourselves of Mr. Smeathman's information, and deliver part of his ample and well drawn up account, in his own words:

"Of a great many curious parts of the creation I met with on my travels in that almost unknown district of Africa, called Guinea, the termites, which by most travellers have been called white ants, seemed to me on many accounts most worthy of that exact and minute attention which I have bestowed upon them.

"The amazing great and sudden mischief they frequently do to the property of people in tropical climates, makes them well known and greatly feared by the inhabitants. The size and figure of their buildings have attracted the notice of many travellers; and yet the world has not hitherto been furnished with a tolerable description of them, though their contrivance and execution scarce fall short of human

ingenuity and prudence: but when we come to consider the wonderful œconomy of these insects, with the good order of their subterraneous cities, they will appear foremost on the list of the wonders of the creation, as most closely imitating mankind in provident industry and regular government.

" The termites are represented by Linnæus as the greatest plagues of both Indies, and are indeed every way between the tropics so deemed, from the vast damages they cause, and the losses which are experienced in consequence of their eating and perforating wooden buildings, utensils, and furniture, with all kinds of household-stuff and merchandise, which are totally destroyed by them, if not timely prevented; for nothing less hard than metal or stone can escape their most destructive jaws.

" These insects have generally obtained the name of ants, it may be presumed, from the similarity in their manner of living, which is, in large communities that erect very extraordinary nests, for the most part on the surface of the ground, from whence their excursions are made through subterraneous passages or covered galleries, which they build whenever necessity obliges, or plunder induces them to march above ground; and at a great distance from their habitations carry on a business of depredation and destruction, scarcely credible but to those who have seen it. But notwithstanding they live in communities, and are like the ants omnivorous; though like them at a certain period they are fur-

nished with four wings, and emigrate or colonize at the same season; they are by no means the same kind of insects, nor does their form correspond with that of ants in any one state of their existence, which, like most other insects, is changed several times. The termites resemble the ants also in their provident and diligent labour, but surpass them, as well as bees, wasps, beavers, and all other animals which I have ever heard of, in the arts of building, as much as the Europeans excel the least cultivated Savages. It is more than probable they excel them as much in sagacity and the arts of government: it is certain they show more substantial instances of their ingenuity and industry than any other animals; and do in fact lay up vast magazines of provisions and other stores; a degree of prudence which of late years has been denied, perhaps without reason, to the ants.

"Their communities consist of one male and one female, (who are generally the common parents of the whole, or greater part of the rest,) and of three orders of insects, apparently of very different species, but really the same, which together compose great commonwealths, or rather monarchies, if I may be allowed the term. The great Linnæus, having seen or heard of but two of these orders, has classed the genus erroneously; for he has placed it among the *aptera*, or insects without wings: whereas the chief order, that is to say, the insect in its perfect state, having four wings without any sting, it

belongs to the *neuroptera*; in which class it will constitute a new genus of many species.

" The different species of this genus resemble each other in form, in their manner of living, and in their good and bad qualities, but differ as much as birds in the method of building their habitations or nests, and in the choice of the materials of which they compose them. There are some species which build upon the surface of the ground, or part above and part beneath, and one or two species, perhaps more, that build on the stems or branches of trees, sometimes aloft at a vast height. Of every species there are three orders; first the working insects, which, for brevity, I shall generally call *labourers*; next the fighting ones, or *soldiers*, which do no kind of labour; and last of all the winged ones, or *perfect insects*, which are male and female, and capable of propagation. These might, very appositely, be called the *nobility* or *gentry*; for they neither labour, or toil, or fight, being quite incapable of either, and almost of self-defence. These only are capable of being elected kings or queens; and Nature has so ordered it, that they emigrate within a few weeks after they are elevated to this state, and either establish new kingdoms, or perish within a day or two.

" The *termes bellicosus*, being the largest species, is most remarkable and best known on the coast of Africa. It erects immense buildings of well tempered clay or earth, which are contrived and finished

with such art and ingenuity, that we are at a loss to say, whether they are most to be admired on that account, or for their enormous magnitude and solidity. It is from the two lower orders of this, or a similar species, that Linnæus seems to have taken his description of the *Termes fatalis*; and most of the accounts brought home from Africa or Asia, of the white ants, are also taken from a species that are so much alike in external habit and size, and build so much in their manner, that one may almost venture to pronounce them mere variations of the same species.

" My general account of the termites is taken from observations made on the *Termes bellicosus*, to which I was induced by the greater facility and certainty with which they could be made. The nests of this species are so numerous all over the island of Bananas, and the adjacent continent of Africa, that it is scarce possible to stand upon any open place, such as a rice plantation, or other clear spot, where one of these buildings is not to be seen within fifty paces, and frequently two or three are to be seen almost close to each other. In some parts near Senegal, as mentioned by Mons. Adanson, their number, magnitude, and closeness of situation, make them appear like the villages of the natives. These buildings are usually termed hills, by natives as well as strangers, from their outward appearance, which is that of little hills more or less conical, generally pretty much in the form of sugar-loaves, and about ten or twelve feet in perpendicular

height above the common surface of the ground. These hills continue quite bare until they are six or eight feet high; but in time the dead barren clay of which they are composed becomes fertilized by the genial power of the elements in these prolific climates, and the addition of vegetable salts and other matters brought by the wind; and in the second or third year, the hillock, if not overshaded by trees, becomes, like the rest of the earth, almost covered with grass and other plants; and in the dry season, when the herbage is burnt up by the rays of the sun, it is not much unlike a very large haycock.

" Every one of these buildings consists of two distinct parts, the exterior and the interior.

" The exterior is one large shell in the manner of a dome, large and strong enough to enclose and shelter the interior from the vicissitudes of the weather, and the inhabitants from the attacks of natural or accidental enemies. It is always, therefore, much stronger than the interior building, which is the habitable part, divided with a wonderful kind of regularity and contrivance into an amazing number of apartments for the residence of the king and queen, and the nursing of their numerous progeny; or for magazines, which are always found well filled with stores and provisions. These hills make their first appearance above-ground by a little turret or two in the shape of sugar-loaves, which are seen a foot high or more. Soon after, at some little distance, while the former are in-

creasing in height and size, they raise others, and so go on increasing the number and widening them at the base, till their works below are covered with these turrets, which they always raise the highest and largest in the middle, and, by filling up the intervals between each turret, collect them as it were into one dome. They are not very curious or exact about these turrets, except in making them very solid and strong; and when by the junction of them the dome is completed, for which purpose the turrets answer as scaffolds, they take away the middle ones entirely, except the tops, (which joined together make the crown of the cupola,) and apply the clay to the building of the works within, or to erecting fresh turrets for the purpose of raising the hillock still higher; so that no doubt some part of the clay is used several times, like the boards and posts of a mason's scaffold. The outward shell, or dome, is not only of use to protect and support the interior buildings from external violence and the heavy rains, but to collect and preserve a regular degree of genial warmth and moisture, which seems very necessary for hatching the eggs and cherishing the young ones.

"The *royal chamber*, which I call so on account of its being adapted for, and occupied by, the king and queen, appears to be, in the opinion of this little people, of the most consequence, being always situated as near the centre of the interior building as possible, and generally about the height of the common surface of the ground, at a pace or two

from the hillock. It is always nearly in the shape of half an egg, or an obtuse oval within, and may be supposed to represent a large oven. In the infant state of the colony it is not above an inch or thereabout in length, but in time will be increased to six or eight inches or more in the clear, being always in proportion to the size of the queen, who, increasing in bulk as in age, at length requires a chamber of such dimensions. Its floor is perfectly horizontal; and in large hillocks, sometimes an inch thick and upwards, of solid clay. The roof also, which is one solid and well turned oval arch, is generally of the same solidity, but in some places it is not a quarter of an inch thick; this is on the sides where it joins the floor, and where the doors, or entrances, are made level therewith at pretty equal distances from each other. These entrances will not admit any animal larger than the soldiers or labourers, so that the king, and the queen (who is, at full size, a thousand times the weight of the king) can never possibly go out.

"The royal chamber, if in a large hillock, is surrounded by an innumerable quantity of others of different sizes, shapes, and dimensions; but all of them arched in one way or another, sometimes circular, and sometimes elliptical or oval. These either open into each other, or communicate by passages as wide, and, being always empty, are evidently made for the soldiers and attendants, of whom it will soon appear great numbers are necessary, and of course always in waiting.

" These apartments are joined by the *magazines and nurseries*. The former are chambers of clay, and are always well filled with provisions, which to the naked eye seem to consist of the raspings of wood and plants which the termites destroy, but are found in the microscope to be principally gums, or the inspissated juices of plants. These are thrown together in little masses, some of which are finer than others, and resemble the sugar about preserved fruits; others are like tears of gum, one quite transparent, another like amber, a third brown, and a fourth quite opaque, as we often see in parcels of ordinary gums. These magazines are intermixed with the nurseries, which are buildings totally different from the rest of the apartments; for these are composed entirely of wooden materials, seemingly joined together with gums. I call them the nurseries, because they are invariably occupied by the eggs and young ones, which appear at first in the shape of labourers, but white as snow. These buildings are exceedingly compact, and divided into many very small irregular-shaped chambers, not one of which is to be found of half an inch in width. They are placed all round the royal apartments, and as near as possible to them. When the nest is in the infant state, the nurseries are close to the royal chamber; but as in process of time the queen enlarges, it is necessary to enlarge the chamber for her accommodation; and as she then lays a greater number of eggs, and requires a greater number of attendants, so it is necessary to enlarge and

increase the number of the adjacent apartments; for which purpose the small nurseries which are first built are taken to pieces, rebuilt a little further off a size bigger, and the number of them increased at the same time. Thus they continually enlarge their apartments, pull down, repair, or rebuild, according to their wants, with a degree of sagacity, regularity, and foresight, not even imitated by any other kind of animals that I have yet heard of. There is one remarkable circumstance attending the nurseries, which I must not at this time omit. They are always found slightly overgrown with mould, and plentifully sprinkled with white globules about the size of a small pin's head. These at first I took to be the eggs; but, on bringing them to the microscope, they evidently appeared to be a species of mushroom, in shape like our eatable mushroom in the young state in which it is pickled. They appear, when whole, white like snow a little thawed and then frozen again, and, when bruised, seem composed of an infinite number of pellucid particles, approaching to oval forms and difficult to separate; the mouldiness seems likewise to be the same kind of substance. The nurseries are enclosed in chambers of clay, like those which contain the provisions, but much larger. In the early state of the nest they are not bigger than a hazel-nut, but in great hills are often as large as a child's head of a year old.

"The disposition of the interior parts of these hills is pretty much alike, except when some in-

surmountable obstacle prevents; for instance, when the king and queen have been first lodged near the foot of a rock or of a tree, they are certainly built out of the usual form, otherwise pretty nearly according to the following plan. The royal chamber is situated at about a level with the surface of the ground, at an equal distance from all the sides of the building, and directly under the apex of the hill. It is on all sides, both above and below, surrounded by what I should call the royal apartments, which have only labourers and soldiers in them, and can be intended for no other purpose than for these to wait in, either to guard or serve their common father and mother, on whose safety depends the happiness, and, according to the negroes, even the existence, of the whole community. These ap rtments compose an intricate labyrinth, which extends a foot or more in diameter from the royal chamber on every side. Here the nurseries and magazines of provisions begin, and, being separated by small empty chambers and galleries, which go round them, or communicate from one to the other, are continued on all sides to the outward shell, and reach up within it two-thirds or three-fourths of its height, leaving an open area in the middle under the dome, which very much resembles the nave of an old cathedral: this is surrounded by three or four very large Gothic-shaped arches, which are sometimes two or three feet high next the front of the area, but diminish very rapidly as they recede from thence like the arches of aisles in perspectives,

and are soon lost among the innumerable chambers and nurseries behind them. All these chambers, and the passages leading to and from them, being arched, they help to support one another; and while the interior large arches prevent them falling into the centre, and keep the area open, the exterior building supports them on the outside. There are, comparatively speaking, few openings into the great area, and they, for the most part, seem intended only to admit that genial warmth into the nurseries which the dome collects.

"The interior building or assemblage of nurseries, chambers, &c., has a flattish top or roof without any perforation, which would keep the apartments below dry, in case through accident the dome should receive any injury and let in water; and it is never exactly flat and uniform, because they are always adding to it by building more chambers and nurseries: so that the divisions or columns between the future arched apartments resemble the pinnacles upon the fronts of some old buildings, and demand particular notice, as affording one proof that for the most part the insects project their arches, and do not make them, as I imagined for a long time, by excavation.

"The area has also a flattish floor, which lies over the royal chamber, but sometimes a good height above it, having nurseries and magazines between. It is likewise water proof, and contrived, as far as I could guess, to let the water off, if it should get in, and run over by some short way into the subter-

raneous passages which run under the lowest apartments in the hill in various directions, and are of an astonishing size, being wider than the bore of a great cannon. I have a memorandum of one I measured, perfectly cylindrical, and thirteen inches in diameter.

"These subterraneous passages, or galleries, are lined very thick with the same kind of clay of which the hill is composed, and ascend the inside of the outward shell in a spiral manner, and, winding round the whole building up to the top, intersect each other at different heights, opening either immediately into the dome in various places, and into the interior building, the new turrets, &c., or communicating thereto by other galleries of different bores or diameters, either circular or oval. From every part of these large galleries are various small pipes or galleries leading to different parts of the building. Under-ground there are a great many which lead downward by sloping descents three and four feet perpendicular among the gravel, from whence the labouring termites cull the finer parts, which, being worked up in their mouths to the consistence of mortar, become that solid clay or stone of which their hills and all their buildings, except their nurseries, are composed. Other galleries again ascend and lead out horizontally on every side, and are carried under-ground near to the surface a vast distance: for, if you destroy all the nests within one hundred yards of your house, the inhabitants of those which are left unmolested

further off, will nevertheless carry on their subterraneous galleries, and invade the goods and merchandise contained in it by sap and mine, and do great mischief if you are not very circumspect.

" But to return to the cities, from whence these extraordinary expeditions and operations originate: It seems there is a degree of necessity for the galleries under the hills being thus large, being the great thoroughfare for all the labourers and soldiers going forth or returning upon any business whatever, whether fetching clay, wood, water, or provisions; and they are certainly well calculated for the purposes to which they are applied, by the spiral slope which is given them; for, if they were perpendicular, the labourers would not be able to carry on their building with so much facility, as they ascend a perpendicular with great difficulty, and the soldiers can scarce do it at all. It is on this account, that sometimes a road like a ledge is made on the perpendicular side of any part of the building within their hill, which is flat on the upper surface and half an inch wide, and ascends gradually like a stair-case, or like those roads which are cut on the sides of hills and mountains, that would otherwise be inaccessible: by which, and similar contrivances, they travel with great facility to every interior part.

" This too is probably the cause of their building a kind of bridge of one vast arch, which answers the purpose of a flight of stairs from the floor of the area to some opening on the side of one of the

columns which support the great arches, which must shorten the distance exceedingly to those labourers who have the eggs to carry from the royal chamber to some of the upper nurseries, which in some hills would be four or five feet in the straightest line, and much more if carried through all the winding passages which lead through the inner chambers and apartments. I have a memorandum of one of these bridges, half an inch broad, a quarter of an inch thick, and ten inches long; making the side of an elliptic arch of proportionable size; so that it is wonderful it did not fall over or break by its own weight before they got it joined to the side of the column above. It is strengthened by a small arch at the bottom, and had a hollow or groove all the length of the upper surface, either made purposely for the inhabitants to travel over with more safety, or else, which is more probable, worn so by frequent treading.

"I have observed before that there are of every species of termites three orders; of these orders the working insects, or *labourers*, are always the most numerous; in the *Termes bellicosus* there seem to be at the least one hundred labourers to one of the fighting insects or soldiers. They are in this state about one fourth of an inch long, and twenty-five of them weigh about a grain; so that they are not so large as some of our ants. From their external habit and fondness for wood, they have been very expressively called wood-lice by some people, and the whole genus has been known by that name, parti-

cularly among the French. They resemble them, it is true, very much at a distance, but they run as fast or faster than any other insects of their size, and are incessantly bustling about their affairs.

"The second order, or *soldiers*, have a very different form from the labourers, and have been by some authors supposed to be the males, and the former neuters; but they are, in fact, the same insects as the foregoing, only they have undergone a change of form, and approached one degree nearer to the perfect state. They are now much larger, being half an inch long, and equal in bulk to fifteen of the labourers. There is now likewise a most remarkable circumstance in the form of the head and mouth; for in the former state the mouth is evidently calculated for gnawing and holding bodies; but in this state, the jaws being shaped just like two very sharp awls a little jagged, they are incapable of any thing but piercing or wounding, for which purposes they are very effectual, being as hard as a crab's claw, and placed in a strong horny head, which is of a nut brown colour, and larger than all the rest of the body together, which seems to labour under great difficulty in carrying it; on which account, perhaps, the animal is incapable of climbing up perpendicular surfaces.

"The third order, or the insect in its perfect state, varies its form still more than ever. The head, thorax, and abdomen, differ almost entirely from the same parts in the labourers and soldiers; and, besides this, the animal is now furnished with

four fine, large, brownish, transparent wings, with which it is at the time of emigration to wing its way in search of a new settlement. In short, it differs so much from its form and appearance in the other two states, that it has never been supposed to be the same animal, but by those who have seen it in the same nest; and some of these have disturbed the evidence of their senses. It was so long before I met with them in the nests myself, that I doubted the information which was given me by the natives, that they belonged to the same family. Indeed we may open twenty nests without finding one winged one; for those are to be found only just before the commencement of the rainy season, when they undergo the last change, which is preparatory to their colonization. Add to this, they sometimes abandon an outward part of their building, the community being diminished by some accident to me unknown. Sometimes, too, different species of the real ant (*formica*) possess themselves by force of a lodgment, and so are frequently dislodged from the same nest, and taken for the same kind of insects. This I know is often the case with the nests of the smaller species, which are frequently totally abandoned by the termites, and completely inhabited by different species of ants, cockroaches, scolopendræ, scorpions, and other vermin, fond of obscure retreats, that occupy different parts of their roomy buildings.

" In their winged state they have also much altered their size as well as form. Their bodies now

measure between six and seven tenths of an inch in length, and their wings above two inches and a half from tip to tip, and they are equal in bulk to about thirty labourers, or two soldiers. They are now also furnished with two large eyes placed on each side of the head, and very conspicuous; if they have any before, they are not easily to be distinguished. Probably in the two first states, their eyes, if they have any, may be small like those of moles; for, as they live like these animals always under-ground, they have as little occasion for these organs, and it is not to be wondered at that we do not discover them; but the case is much altered when they arrive at the winged state, in which they are to roam, though but a few hours, through the wide air, and explore new and distant regions. In this form the animal comes abroad during or soon after the first tornado, which at the latter end of the dry season proclaims the approach of the ensuing rains, and seldom waits for a second or third shower, if the first, as is generally the case, happens in the night, and brings much wet after it.

" The quantities that are to be found the next morning all over the surface of the earth, but particularly on the waters, is astonishing; for their wings are only calculated to carry them a few hours, and after the rising of the sun not one in a thousand is to be found with four wings, unless the morning continues rainy, when here and there a solitary being is seen winging its way from one place to another, as if solicitous only to avoid its

numerous enemies, particularly various species of ants, which are hunting on every spray, on every leaf, and in every possible place, for this unhappy race; of which probably not a pair in many millions get into a place of safety, fulfil the first law of nature, and lay the foundation of a new community. Not only all kinds of ants, birds, and carnivorous reptiles, as well as insects, are upon the hunt for them; but the inhabitants of many countries, and particularly of that part of Africa where I was, eat them. On the following morning, however, as I have observed, they are to be seen running upon the ground in chase of each other; sometimes with one or two wings still hanging to their bodies, which are not only useless, but seem rather cumbersome. The greater part have no wings, but they run exceeding fast, the males after the females; I have sometimes remarked two males after one female, contending with great eagerness who should win the prize, regardless of the innumerable dangers that surrounded them.

"They are now become from one of the most active, industrious, and rapacious, one of the most fierce and implacable little animals in the world, the most innocent, helpless, and cowardly; never making the least resistance to the smallest ant. The ants are to be seen on every side in infinite numbers, of various species and sizes, dragging these annual victims of the laws of nature to their different nests. It is wonderful that a pair should ever escape so many dangers, and get into a place

of security. Some, however, are so fortunate; and being found by some of the labouring insects that are continually running about the surface of the ground under their covered galleries, which I shall shortly describe, are elected kings and queens of new states; all those who are not so elected and preserved certainly perish, and most probably in the course of the following day. The manner in which these labourers protect the happy pair from their innumerable enemies, not only on the day of the massacre of almost all their race, but for a long time after, will I hope justify me in the use of the term election. The little industrious creatures immediately enclose them in a small chamber of clay suitable to their size, into which at first they leave but one small entrance, large enough for themselves and the soldiers to go in and out, but much too little for either of the royal pair to make use of; and when necessity obliges them to make more entrances, they are never larger, so that, of course, the voluntary subjects charge themselves with the task of providing for the offspring of their sovereigns, as well as to work, and to fight for them, until they shall have raised a progeny capable at least of dividing the task with them.

" About this time a most extraordinary change begins to take place in the queen, to which I know nothing similar, except in the *Pulex penetrans* of Linnæus, the Jigger of the West Indies, and in the different species of *Coccus*, cochineal. The abdomen of this female begins gradually to extend and

enlarge to such an enormous size, that an old queen will have it increased so as to be fifteen hundred or two thousand times the bulk of the rest of her body, and twenty or thirty thousand times the bulk of a labourer, as I have found by carefully weighing and computing the different states. The skin between the segments of the abdomen extends in every direction; and at last the segments are removed to half an inch distance from each other, though at first the length of the whole abdomen is not half an inch. They preserve their dark brown colour, and the upper part of the abdomen is marked with a regular series of brown bars, from the thorax to the posterior part of the abdomen; while the intervals between them are covered with a thin, delicate, transparent skin, and appear of a fine cream colour, a little shaded by the dark colour of the intestines, and watery fluid, seen here and there beneath. I conjecture the animal is upwards of two years old when the abdomen is increased to three inches in length: I have sometimes found them of near twice that size. The abdomen is now of an irregular oblong shape, being contracted by the muscles of every segment, and is become one vast matrix full of eggs, which make long circumvolutions through an innumerable quantity of very minute vessels that circulate round the inside in a serpentine manner, which would exercise the ingenuity of a skilful anatomist to dissect and develop. This singular matrix is not more remarkable for its amazing extension and size, than for its

peristaltic motion, which resembles the undulating of waves, and continues incessantly, without any apparent effort of the animal; so that one part or other is alternately rising and sinking in perpetual succession, and the matrix seems never at rest, but is always protruding eggs, to the amount (as I have frequently counted in old queens) of sixty in a minute, or eighty thousand and upwards in one day of twenty-four hours. These eggs are instantly taken from her body by her attendants (of whom there always are, in the royal chambers and galleries adjacent, a sufficient number in waiting) and carried to the nurseries, which in a great nest may some of them be four or five feet distant in a straight line, and consequently much further by their winding galleries. Here, after they are hatched, the young are attended, and provided with every thing necessary until they are able to shift for themselves, and take their share of the labours of the community. The foregoing, I flatter myself, is an accurate description and account of the *Termes bellicosus*, or species that builds the large nests in its different states.

"The termites, except their heads, are exceeding soft, and covered with a thin and delicate skin; being blind, they are no match on open ground for the ants, who can see, and are all of them covered with a strong horny shell not easily pierced, and are of dispositions bold, active, and rapacious. Whenever the termites are dislodged from their covered ways, the various species of the former, who

probably are as numerous above ground as the latter are in their subterraneous passages, instantly seize and drag them away to their nests, to feed the young brood.

"The termites are, therefore, exceeding solicitous about the preserving their covered ways in good repair; and if you demolish one of them for a few inches in length, it is wonderful how soon they rebuild it. At first, in their hurry, they get into the open part an inch or two, but stop so suddenly that it is very apparent they are surprised; for though some run straight on, and get under the arch as speedily as possible in the former part, most of them run as fast back, and very few will venture through that part of the track which is left uncovered. In a few minutes you will perceive them rebuilding the arch, and by the next morning they will have restored their gallery for three or four yards in length, if so much has been ruined; and upon opening it again will be found as numerous as ever under it, passing both ways. If you continue to destroy it several times, they will at length seem to give up the point, and build another in a different direction; but, if the old one lead to some favourite plunder, in a few days will rebuild it again; and, unless you destroy their nest, never totally abandon their gallery."

After having described the *Termes bellicosus* in the foregoing accurate manner, Mr. Smeathman proceeds to notice another species equally ingenious, but inhabiting different situations.

"The *Termites arborum*, those which build in trees, frequently establish their nests within the roofs and other parts of houses, to which they do considerable damage, if not timely extirpated. The large species are, however, not only much more destructive, but more difficult to be guarded against, since they make their approaches chiefly under ground, descending below the foundations of houses and stores of several feet from the surface, and rising again either in the floors; or, entering at the bottoms of the posts, of which the sides of the buildings are composed, bore quite through them, following the course of the fibres to the top, or making lateral perforations and cavities here and there as they proceed.

"While some are employed in gutting the posts, others ascend from them, entering a rafter or some other part of the roof. If they once find the thatch, which seems to be a favourite food, they soon bring up wet clay, or build their pipes or galleries through the roof in various directions, as long as it will support them; sometimes eating the palm-tree leaves and branches of which it is composed, and perhaps (for variety seems very pleasing to them) the rattan or other running plant, which is used as a cord to tie the various parts of the roof together, and that to the posts which support it: thus, with the assistance of the rats, who during the rainy season are apt to shelter themselves there, and to burrow through it, they very soon ruin the house by weakening the fastenings and exposing

it to the wet. In the mean time the posts will be perforated in every direction as full of holes as that timber in the bottom of ships which has been bored by the worms; the fibres and knotty parts, which are the hardest, being left to the last.

" They sometimes, in carrying on this business, find, I will not pretend to say how, that the post has some weight to support; and then, if it is a convenient track to the roof, or is itself a kind of wood agreeable to them, they bring their mortar, and fill all or most of the cavities, leaving the necessary roads through it, and as fast as they take away the wood replace the vacancy with that material; which being worked together by them closer and more compactly than human strength or art could ram it, when the house is pulled to pieces, in order to examine if any of the posts are fit to be used again, those of the softer kinds are often found reduced almost to a shell, and all or a greater part transformed from wood to clay as solid and as hard as many kinds of free stone used for building in England. It is much the same when the *Termites bellicosi* get into a chest or trunk containing clothes and other things: if the weight above is great, or they are afraid of ants or other enemies, and have time, they carry their pipes through, and replace a great part with clay, running their galleries in various directions. The tree termites, indeed, when they get within a box, often make a nest there, and being once in possession destroy it at their leisure. They did so in a pyramidical box which contained

my compound microscope. It was of mahogany, and I had left it in the store of Colonel Campbell of Tobago, for a few months, while I made the tour of the Leeward Islands. On my return I found these insects had done much mischief in the store, and, among other things, had taken possession of the microscope, and eaten every thing about it except the glass or metal, and the board on which the pedestal is fixed, with the drawers under it, and the things enclosed. The cells were built all round the pedestal and the tube, and attached to it on every side. All the glasses which were covered with the wooden substance of their nests, retained a cloud of a gummy nature upon them that was not easily got off, and the lacker or burnish with which the brass work was covered was totally spoiled. Another party had taken a liking to a Madeira cask, and had let out almost a pipe of fine old wine. If the large species of Africa (the *Termites bellicosi*) had been so long in the uninterrupted possession of such a store, they would not have left twenty pounds weight of wood remaining of the whole building, and all that it contained.

"These insects are not less expeditious in destroying the shelves, wainscoting, and other fixtures of a house, than the house itself. They are for ever piercing and boring in all directions, and sometimes go out of the broadside of one post into that of another joining to it; but they prefer and always destroy the softer substances the first, and are particularly fond of pine and fir boards, which

they excavate and carry away with wonderful dispatch and astonishment; for, except a shelf has something standing upon it, as a book, or any thing else that may tempt them, they will not perforate the surface, but artfully preserve it quite whole, and eat away all the inside, except a few fibres which barely keep the two sides connected together; so that a piece of an inch-board which appears solid to the eye, will not weigh much more than two sheets of paste-board of equal dimensions, after these animals have been a little while in possession of it. In short, the termites are so insidious in their attacks, that we cannot be too much on our guard against them: they will sometimes begin and raise their works, especially in new houses, through the floor. If you destroy the work so begun, and make a fire upon the spot, the next night they will attempt to rise through another part; and, if they happen to emerge under a chest or trunk early in the night, will pierce the bottom, and destroy or spoil every thing in it before the morning. On these accounts we are careful to set all our chests and boxes upon stones or bricks, so as to leave the bottoms of such furniture some inches above the ground; which not only prevents these insects finding them out so readily, but preserves the bottoms from a corrosive which would strike from the earth through, and rot every thing therein: a vast deal of vermin also would harbour under, such as cock-roaches, centipedes, millepedes, scorpions, ants. and various other noisome insects.

" When the termites attack trees and branches in the open air, they sometimes vary their manner of doing it. If a stake in a hedge has not taken root and vegetated, it becomes their business to destroy it. If it has a good sound bark round it, they will enter at the bottom, and eat all but the bark, which will remain, and exhibit the appearance of a solid stick (which some vagrant colony of ants or other insects often shelter in till the winds disperse it); but if they cannot trust the bark, they cover the whole stick with their mortar, and it then looks as if it had been dipped into thick mud that had been dried on. Under this covering they work, leaving no more of the stick and bark than is barely sufficient to support it, and frequently not the smallest particle; so that, upon a very small tap with your walking-stick, the whole stake, though apparently as thick as your arm, and five or six feet long, loses its form, and, disappearing like a shadow, falls in small fragments at your feet. They generally enter the body of a large tree, which has fallen through age or been thrown down by violence, on the side next the ground, and eat away at their leisure within the bark, without giving themselves the trouble either to cover it on the outside, or to replace the wood which they have removed from within, being somehow sensible that there is no necessity for it. These excavated trees have deceived me two or three times in running: for, attempting to step two or three feet high, I might as well have attempted to step upon a cloud, and have

come down with such unexpected violence, that, besides shaking my teeth and bones almost to dislocation, I have been precipitated, head foremost, among the neighbouring trees and bushes. Sometimes, though seldom, the animals are known to attack living trees; but not, I apprehend, before symptoms of mortification have appeared at the roots; since it is evident, as is before observed, that these insects are intended in the order of nature to hasten the dissolution of such trees and vegetables as have arrived at the greatest maturity and perfection, and which would, by a tedious decay, serve only to encumber the face of the earth. This purpose they answer so effectually, that nothing perishable escapes them, and it is almost impossible to leave any thing penetrable upon the ground a long time in safety; for the odds are, that, put it where you will abroad, they will find it out before the following morning, and its destruction follows very soon of course. In consequence of this disposition, the woods never remain long encumbered with the fallen trunks of trees or their branches; and thus it is, as I have before observed, the total destruction of deserted towns is so effectually completed, that in two or three years a thick wood fills the space; and, unless iron-wood posts have been made use of, not the least vestige of a house is to be discovered.

"The first object of admiration which strikes one upon opening their hills is the behaviour of the soldiers. If you make a breach in a slight part

of the building, and do it quickly with a strong hoe or pick-axe, in the space of a few seconds a soldier will run out and walk about the breach, as if to see whether the enemy is gone, or to examine what is the cause of the attack. He will sometimes go again, as if to give the alarm; but most frequently, in a short time, is followed by two or three others, who run as fast as they can, straggling after one another, and are soon followed by a large body who rush out as fast as the breach will permit them; and so they proceed, the number increasing as long as any one continues battering their building. It is not easy to describe the rage and fury they show. In this hurry they frequently miss their hold and tumble down the sides of the hill, but recover themselves as quickly as possible; and, being blind, bite every thing they run against, and thus make a crackling noise; while some of them beat repeatedly with their forceps upon the building, and make a small vibrating noise, something shriller and quicker than the ticking of a watch: I could distinguish this noise at three or four feet distance, and it continued for a minute at a time, at short intervals. While the attack proceeds they are in the most violent bustle and agitation. If they get hold of any one, they will in an instant let out blood enough to weigh against their whole body; and if it is the leg they wound, you will see the stain upon the stocking extend an inch in width. They make their hooked jaws meet at the first stroke, and never quit their hold, but

suffer themselves to be pulled away leg by leg, and piece after piece, without the least attempt to escape. On the other hand, keep out of their way, and give them no interruption, and they will in less than half an hour retire into the nest, as if they supposed the wonderful monster that damaged their castle to be gone beyond their reach. Before they are all got in, you will see the labourers in motion, and hastening in various directions towards the breach; every one with a burthen of mortar in his mouth ready tempered. This they stick upon the breach as fast as they come up, and do it with so much dispatch and facility, that although there are thousands, and I may say millions of them, they never stop or embarrass one another; and you are most agreeably deceived when, after an apparent scene of hurry and confusion, a regular wall arises, gradually filling up the chasm. While they are thus employed, almost all the soldiers are retired quite out of sight, except here and there one, who saunters about among six hundred or a thousand of the labourers, but never touches the mortar either to lift or carry it; one in particular places himself close to the wall they are building. This soldier will turn himself leisurely on all sides, and every now and then, at intervals of a minute or two, lift up his head, and with his forceps beat upon the building, and make the vibrating noise before mentioned; on which immediately a loud hiss, which appears to come from all the labourers, issues from within side the dome, and all the subterraneous ca-

verns and passages: that it does come from the labourers is very evident, for you will see them all hasten at every such signal, redouble their pace, and work as fast again.

" As the most interesting experiments become dull by repetition or continuance, so the uniformity with which this business is carried on, though so very wonderful, at last satiates the mind. A renewal of the attack, however, instantly changes the scene, and gratifies our curiosity still more. At every stroke we hear a loud hiss; and on the first the labourers run into the many pipes and galleries with which the building is perforated, which they do so quickly that they seem to vanish; for in a few seconds all are gone, and the soldiers rush out as numerous and as vindictive as before. On finding no enemy they return again leisurely into the hill, and very soon after the labourers appear loaded as at first, as active and as sedulous, with soldiers here and there among them, who act just in the same manner, one or other of them giving the signal to hasten the business. Thus the pleasure of seeing them come out to fight or work alternately, may be obtained as often as curiosity excites, or time permits; and it will certainly be found, that the one order never attempts to fight, or the other to work, let the emergency be ever so great.

" We meet vast obstacles in examining the interior parts of these tumuli. In the first place the works, for instance the apartments which surround the royal chamber and the nurseries, and indeed

the whole fabric, are moist, and consequently the clay is very brittle; they have also so close a connexion, that they can only be seen as it were by piece-meal; for, having a kind of geometrical dependence or abutment against each other, the breaking of one arch pulls down two or three. To these obstacles must be added the obstinacy of the soldiers, who fight to the very last, disputing every inch of ground so well, as often to drive away the negroes who are without shoes, and make white people bleed plentifully through their stockings. Neither can we let a building stand so as to get a view of the interior parts without interruption; for, while the soldiers are defending the out-works, the labourers keep barricading all the way against us, stopping up the different galleries and passages which lead to the various apartments; particularly the royal chamber, all the entrances to which they fill up so artfully as not to let it be distinguishable while it remains moist; and externally it has no other appearance than that of a shapeless lump of clay. It is however easily found, from its situation with respect to the other parts of the building, and by the crowds of labourers and soldiers which surround it, who show their loyalty and fidelity by dying under its walls. The royal chamber, in a large nest, is capacious enough to hold many hundreds of the attendants, besides the royal pair, and you always find it as full of them as it can hold. These faithful subjects never abandon their charge even in the last distress; for, whenever I took out

the royal chamber, and, as I often did, preserved it for some time in a large glass bowl, all the attendants continued running in one direction round the king and queen with the utmost solicitude, some of them stopping on every circuit at the head of the latter, as if to give her something. When they came to the extremity of the abdomen, they took the eggs from her, and carried them away, and piled them carefully together in some part of the chamber, or in the bowl under, or behind any pieces of broken clay which lay most convenient for the purpose.

" Some of these little unhappy creatures would ramble from the chamber, as if to explore the cause of such horrid ruin and catastrophe to their immense building, as it must appear to them; and, after fruitless endeavours to get over the side of the bowl, return and mix with the crowd that continue running round their common parents to the last. Others, placing themselves along her side, get hold of the queen's vast matrix with their jaws, and pull with all their strength so as visibly to lift up the part which they fix at; but, as I never saw any effects from these attempts, I never could determine whether this pulling was with an intention to remove her body, or to stimulate her to move herself, or for any other purpose; but, after many ineffectual tugs, they would desist, and join in the crowd running round, or assist some of those who are cutting off clay from the external parts of the chamber, or some of the fragments, and moistening it with the juices of their bodies, to begin to work a thin arched shell

over the body of the queen, as if to exclude the air, or to hide her from the observation of some enemy. These, if not interrupted, before the next morning completely cover her, leaving room enough within for great numbers to run about her.

" I do not mention the king in this case, because he is very small in proportion to the queen, not being bigger than thirty of the labourers, so that he generally conceals himself under one side of the abdomen, except when he goes up to the queen's head, which he does now and then, but not so frequently as the rest.

" If in your attack on the hill you stop short of the royal chamber, and cut down about half of the building, and leave open some thousands of galleries and chambers, they will all be shut up with thin sheets of clay before the next morning. If even the whole is pulled down, and the different buildings are thrown in a confused heap of ruins, provided the king and queen are not destroyed or taken away, every interstice between the ruins, at which either cold or wet can possibly enter, will be so covered as to exclude both; and, if the animals are left undisturbed, in about a year they will raise the building to near its pristine size and grandeur."

Having thus concluded the history of these most ingenious creatures, we ought perhaps to apologize for having inserted the account in so full a manner: but, when we consider the almost incredible operations of these animals, their order and regularity at home, and their astonishing industry in the

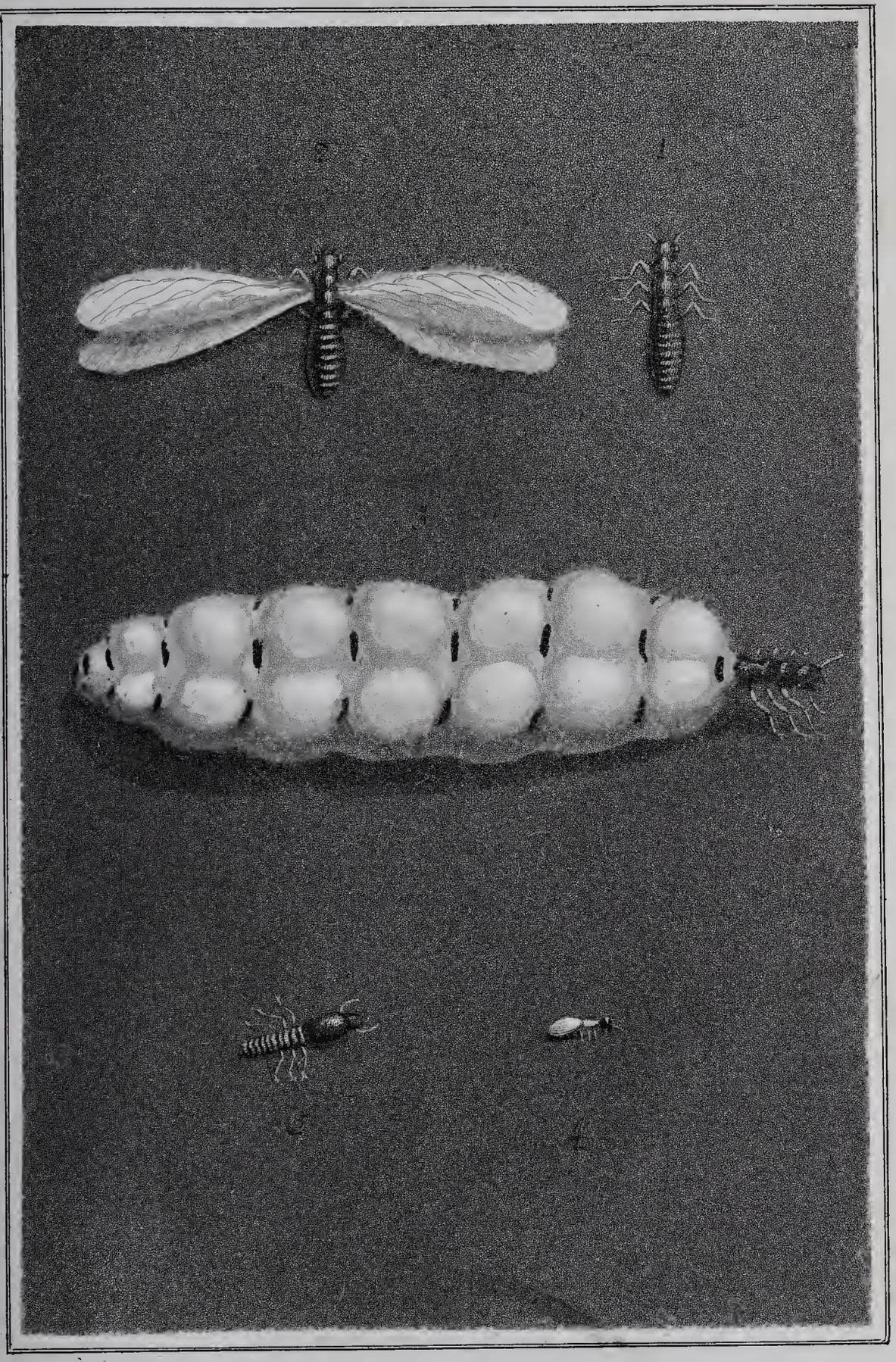
field, the colony becomes an object of too much importance to be passed over without due examination; and, being apprehensive that a degree of doubt might probably be raised in the minds of some of our readers at the recital of their extraordinary abilities, we thought it most proper to relate the facts as they are stated by the intelligent observer.

Among the different species of this genus is the *Termes pulsatorius*, well known in most houses for its particular beat, which resembles the ticking of a watch, and has given rise to many fears among those who are either weak enough to believe in omens, or willing to alarm themselves whenever they have an opportunity.

EXPLANATION OF THE PLATES.

Pl. 13. *fig.* 1.—The king.
2.—A male.
3.—The pregnant queen.
4.—A labourer.
5.—A soldier.

Pl. 14. represents the white ants' nests as they appear after they have been built some time and washed into furrows by the rains.



WHITE ANTS.

Designed by W. Daniell.

Published by Messrs Cadell & Davies London March 1 1807.

WHITE ANTS NESTS.

Designed by W. Daniell.

Published by Messrs Cadell & Davies London March 1 1807.

SPIDER.

GENERIC CHARACTER.

Antennæ none.
Eyes eight.
Mouth armed with two crotchets.
End of the abdomen provided with instruments for spinning, shaped like nipples.

SPECIFIC CHARACTER.

ARANEA DOMESTICA. A. abdomine ovato fusco : maculis nigris quinque subcontiguis; anterioribus majoribus. *Linn. Syst. Nat. Gmel.* 1. p. 2952.

Body brown, and of an oval shape, with five black spots near together, of which the two anterior are the largest.

ARANEA DERHAMII. *Scop. Ent. Carn.* 1104.

HOUSE SPIDER. . . *Degeer Ins.* 7. p. 264. no. 19. pl. 15. f. 11. *Clerck. Aran.* 76. pl. 2. f. 9. *List. Aran.* 59. f. 17.

THERE is something so disgusting in spiders to persons in general, that many who would otherwise be well inclined to observe their curious operations, cannot find resolution enough to overcome their

prejudices, and therefore neglect what would amply repay them for their trouble. This antipathy, which we believe to be as often natural as acquired, is so strongly implanted in the minds of some persons, that they shudder whenever the animal appears; and we know one instance, where a person of strong mental powers, and, in other respects, of great personal courage, will at any time leave the room rather than encounter a spider. Naturalists themselves have been impressed with the same feelings, and not even the ardour of the pursuit could induce either Roesel or Göze to examine these insects minutely, till they were accustomed to observe them at a distance.

Before we attend particularly to the manners of the house spider, we shall describe those parts which are common to the species in general, some of the most curious of which we shall notice hereafter.

Every spider has two parts, of which the fore one that contains the head and breast, is separated from the hinder part, or belly, by a very slender thread. The fore part is covered with strong scales, and so are the feet, which are inserted in the breast. The hinder part is clothed with a very fine and supple skin, and the whole invested with hair. They have several eyes; but they differ in number, some species having eight, others six, and some no more than four. In all they are immoveable, and covered with a hard polished crust. The whole tribe have two stings, or rather branches, pro-

ceeding from the fore part of the head, which are indented with strong points, like a couple of saws, and ending in a nail made like the claw of a cat. Near the point of the nail is a small aperture, through which it is evident, they eject a very virulent poison. They have no arms so formidable to their enemies as these. They occasionally open and extend their two branches, and when they no longer make use of their nails they bend and bring each of them down upon its branch, like a pruning-knife clasped upon its handle.

They all likewise have eight legs, jointed like those of crabs; and at the extremity of these legs, three crooked and moveable claws, that is to say, a small one placed on one side, like a spur, by the assistance of which they fasten themselves to their thread; and two others of a larger size, the internal part of whose curve is indented, and which serve them to fix themselves where they please, and enable them to slide either obliquely, or with their back downwards, by grasping whatever comes in their way. They have likewise two little round balls or sponges at the bottom of their feet, on which they advance with a softer pace, and draw in their bending claws in order to preserve them on those occasions where they can dispense with their agency. Besides these eight legs, spiders have two others, inserted into the fore part of their body, and which we may call their arms, since they do not use them for transferring themselves from one place to another, but only for holding, and turning their

prey. But with all this formidable equipage, the spider would be unsuccessful in her wars, were she not as well accommodated with instruments to form an ambush, as with weapons for an attack. She has no wings to assist her in the pursuit of her prey, which could never be obtained by her if she was not endowed with a good stock of thread, and sufficient industry to spin it into a web, or snare. This she spreads in the open air, and when her task is completed she retires into a chamber in the back part of the net, where, quite invisible, she patiently awaits the enemy.

All spiders at the extremity of their belly, have five teats or papillæ, covered with others of lesser dimensions, the orifices of which they open and shut, as well as contract and dilate, at pleasure. Through these orifices they distil that clammy gum with which their belly is replenished; and whilst the spider discharges it through one or more apertures, the thread lengthens in proportion to her distance from the place she first fastened it. When she closes the openings of her dugs, the threads no longer lengthen, and she remains suspended in the air. She afterwards makes use of this thread for her ascent, by grasping it in her paws, as some people climb up a rope with their hands and knees. With this thread she spins a web, that furnishes her with advantages of a very different nature.

Having thus noticed the parts which are common to the species in general, we shall now proceed to de-

scribe the manner in which the house spider constructs its snare. When this creature intends to begin a web, she first chooses a place that has some recess, as the corner of a chamber, or a piece of furniture, into which she may retreat under her web, and secure herself a passage either upwards or downwards, and by these means accomplish her escape from any danger that may occur; she sheds upon the wall a little drop of her gum, which immediately sticks to it. The spider then lets the liquor distil through a smaller orifice. Her thread lengthens in her rear, while she proceeds from one side as far as the place to which she designs to extend her web. The thread is fastened to one of her spurs, lest it should fix along the wall, whilst her intention is that it should only traverse the air. When she is arrived at the point to which she purposes to continue her web from the opposite side, she there fastens this first thread by the help of the glue; and afterwards draws it to her, first bending and then stretching it tight. Close by this thread she fixes another, which she carries forward by running along the first, and proceeds to glue the second thread on one side of the point where she began her work. The two first threads serve as a base to which she connects all the rest. In this manner she passes and repasses several times, connecting or separating her threads as she judges convenient. It is said that she forms several threads at once, and in order to keep them separated at an equal distance, without intermingling with each other, she distributes them

into the teeth of the comb, which may be distinctly seen under each of the large nails on her paws. These threads are stretched and bound one after another with the same industry as the first. In this manner she finishes the horizontal range of threads, after which she begins to work transversely. In this proceeding the web of a spider differs from our weaver's work, inasmuch as in our weaving the threads extended in length are interlaced with those that are carried on transversely; whereas, the threads of a spider's woof only cross the threads of the warp, and are glued to them in the points where they mutually touch, and are not inserted or interwoven. After this the spider doubles and trebles the threads that bordered her work, by opening all her dugs at once, and glueing several threads one over another. She is sensible that the extremity of the thread ought to be well secured to preserve it from being torn; and in order to make the whole as steady as possible, and to prevent its being torn by the wind, she fixes all around it a number of strong loops, or double threads.

The web, thus constructed, is a piece of mechanism which does great credit to the little artist, and cannot fail to raise our admiration of that Being who has enabled so insignificant an insect to perform so exquisite a work. This however is not all; conscious that an animal that lives by rapine, and spreads snares for its prey, would never succeed while she remained exposed on the edge of her own net, the same instinct which guided her before, now

directs her to form a lodge where she may lie concealed; and this is contrived at the bottom of her web, where she continues a close prisoner, and keeps a constant watch for the unwary prey. There are two outlets to the lodge, one above and the other below, which give her an opportunity of being every where when necessary, and of visiting and cleaning all the parts. From all parts of the web are drawn several threads, that terminate like rays in the centre, and it is in this centre that the lodge is wisely formed; for the sound made by the vibration of one of these threads, is immediately communicated to the spider within, and gives her notice of game in her nets. This retreat likewise affords her another advantage of some consequence, as she can there not only feed in full security, but conceal the carcases of the dead from the observation of other insects, who might probably be intimidated from approaching a place where any traces of her barbarity were to be seen.

While the spider continues vigorous and in health the glands which secrete the gum are sufficient for her purpose, and the web which is destroyed to-day will be completed again by to-morrow. Enemies are continually injuring her work, without abating her industry, which seems to rise superior to these difficulties; and while her magazine of gum continues to be replenished, she soon repairs her web. This however does not always last, the reservoir is at length drained of its supplies; for when the spider grows old, both the gum and the sponges on her

feet are dried up; and then, being unable to construct a web for herself, she either forces a young spider to give up her net, or perishes for want of subsistence.

The faculty which many animals possess of counterfeiting death in order to disarm, and thus escape from their enemies, is extended to the spider; which, if much alarmed, will contract all its limbs and become perfectly motionless. In this state the insect will remain, while under the influence of fear, notwithstanding the severest treatment we can inflict upon it, and will even suffer itself to be torn into pieces without exhibiting the smallest sign of life. This obstinate perseverance is the more remarkable, as it is not owing, as some have supposed, to a state of insensibility; since if the cause of terror be removed, the spider will soon stretch forth its legs and run away.

We must in the next place proceed to notice the operations of the garden spider, *Aranea horticula*, Linn., which differs from the domestic kind in several particulars. The labours of this species appear to be very peculiar, and the manner of constructing the web very different from the rest. Many suppose this insect flies when they see her pass from branch to branch without any apparent support, but this is not the case: she places herself upon the end of a branch, or some other projecting body, and there fastens her thread; after which with her two hind feet she squeezes her dugs, and presses out one or more threads of two or three yards in length,

which she leaves floating in the air. These threads are wafted by the wind from one side to another, and lodged on a tree, a stake, or any thing that may happen to be in the way, to which they are fastened by their natural glue. She afterwards draws them towards her, to try if they are well fixed or not, and then they become a bridge, over which the spider passes and repasses in full liberty. She doubles and extends the thread as much as she thinks fit, by joining the shortest slips together, and then marches over a third part, or to the middle of the same thread, and adds another to it, by the aid of which she descends till she meets with a stone, a plant, or some solid body to rest on, or else she leaves it to fluctuate in the air, till it be fixed to some particular place. By this second thread she ascends to the first, and at some distance begins a third, which she fastens by the same management. When she has fixed three threads, she makes them stronger by doubling them, and then by passing in a different direction forms a square, in which she makes a cross with the same industry, whose middle point becomes a centre. To this centre she draws threads from every side, like the spokes of a wheel, which all terminate in the nave. Round this centre she projects a small circle, after which she begins another a little more distant, and always continues to draw this circular thread from one spoke to another, till she comes to the large threads which sustain the whole work.

When the net is thus spread, her next care is to

entrap the game; for which purpose she places herself in the centre of all these circles, with her head downwards. She chooses this posture as the best means of supporting her large belly, which in any other position would soon fatigue her by its weight. Thus she waits for her prey with which the air is generally so replenished that a sufficient quantity soon falls into her net. When a small fly becomes her captive, she dispatches it upon the spot, because it is a repast which does not require much preparation; but when her provision is larger, and happens to be a strong fly who makes a vigorous resistance, the spider, wheeling about, involves him in a number of threads, with which she entangles, fetters, and then keeps him suspended in the air; after which she bears him away to the nest below her web, which is generally made in some sheltered situation, where she may securely pass the night and be at the same time shelered from the rain.

This insect can exist for a great length of time without food. It has been enclosed under a bell glass and left for ten months without the smallest quantity of nourishment, and during that time the spider appeared vigorous, though its body was exceedingly diminished in consequence of its confinement. When another in full health was introduced as a companion, the meagre one soon commenced an attack, and after repeated attempts at length killed the stranger, which it immediately devoured, and in less than twenty-four hours recovered its former size.

Among the different species of this genus is a little spider which fills our fields in the autumn with its delicate web: this may be seen floating on the surface of the grass, or attached to the stalks of the corn, in great abundance; and the diminutive creature that spins this tender thread is called the gossamer spider. These cobwebs must have occurred to every one who is accustomed to the country, as they frequently float in the air and come across the face of the traveller as he passes through the corn-fields. These little spiders, though destitute of wings, seem to be possessed of the power of flight; for they have been seen shooting into the air to a very considerable height, and have been traced as far as the eye could follow them. The learned Dr. Lister made several observations on this curious property, and attempted to ascertain the height to which they soared; but this he was unable to do; for after having ascended some of the highest edifices, he still saw the little travellers sailing above him as far as the eye could reach.

Mr. White of Selborne has given us the following account of the gossamer, which being drawn up from actual observation will be best delivered in his own words. "On September 21, 1741, being then on a visit and intent on field diversions, I rose before day-break. When I came into the inclosures, I found the stubbles and clover grounds matted all over with a thick coat of cobwebs, in the meshes of which a copious and heavy dew hung so plentifully that the whole face of the country seemed, as it

were, covered with two or three setting-nets drawn over one another. When the dogs attempted to hunt, their eyes were so blinded and hood-winked that they could not proceed, but were compelled to lie down and scrape the incumbrances from their faces with their fore feet; so that, finding my sport interrupted, I returned home, musing in my mind on the oddness of the occurrence.

"As the morning advanced, the sun became bright and warm, and the day turned out one of those most lovely ones which no season but the autumn produces; cloudless, calm, serene, and worthy of the South of France itself. About nine an appearance very unusual began to demand our attention: a shower of cobwebs falling from very elevated regions, and continuing without any interruption till the close of day. These webs were not single filmy threads, floating in the air in all directions, but perfect flakes or rags, some nearly an inch broad and five or six long, which fell with a degree of velocity that showed they were considerably heavier than the atmosphere. On every side, as the observer turned his eyes, he might behold a continual succession of fresh flakes falling into his sight, and twinkling like stars, as they turned their sides toward the sun. How far this wonderful shower extended would be difficult to say; but we know that it reached Bradley, Selborne, and Alresford, three places which lie in a sort of triangle; the shortest of whose sides is about eight miles in extent.

" At the second of those places there was a gentleman (for whose veracity and intelligent turn of mind I have the greatest veneration) who observed it the moment he got abroad; but concluded that as soon as he came upon the hill above his house, where he took his morning rides, he should be higher than the meteor; which he imagined might have been blown like thistle-down from the common above. But, to his great astonishment, when he rode to the most elevated part of the down, three hundred feet above the level of his fields, he found the webs in appearance as much above him as before, still ascending in a constant succession, and twinkling in the sun, so as to draw the attention of the most incurious. Neither before nor after this was any such fall observed; but on this day the flakes hung in the trees and hedges so thick that a diligent person sent out might have gathered baskets full.

" The remark that I shall make on these cobweb-like appearances, called gossamer, is, that strange and superstitious as the notions about them were formerly, no body in these days doubts but they are the real productions of small spiders, which swarm in the fields in fine weather in autumn, and have a power of shooting out webs from their tails so as to render themselves buoyant, and lighter than air. But why these apterous insects should *that day* take such a wonderful aërial excursion, and why their webs should at once become so gross

and material as to be considerably more weighty than air, and to descend with precipitation, is a matter beyond my skill. If I may be allowed to hazard a supposition, I should imagine that those filmy threads, when first shot, might be entangled in the rising dew, and so drawn up, spiders and all, by a brisk evaporation into the regions where clouds are formed; and if the spiders have a power of coiling and thickening their webs in the air, as Dr. Lister says they have, then, when they become heavier than the air, they must fall.

"Every day in fine weather, in autumn chiefly, do I see these spiders shooting out their webs and mounting aloft; they will go off from your finger, if you take them into your hand. Last summer one alighted on my book as I was reading in the parlour; and, running to the top of a page, and shooting out a web, took its departure from thence. But what I most wondered at was, that it went off with considerable velocity in a place where no air was stirring; and I am sure I did not assist it with my breath. So that these little crawlers seem to have, while mounting, some locomotive power without the use of wings, and to move in the air faster than the air itself."

As a contrast to this aërial species we may be allowed to mention the water spider, *Aranea aquatica*, Linn., which is generally found in very clear ponds, where it spins itself a web and passes its time with as much freedom as the rest. The body of this

BIRD CATCHING SPIDER.

Designed by W. Daniell.

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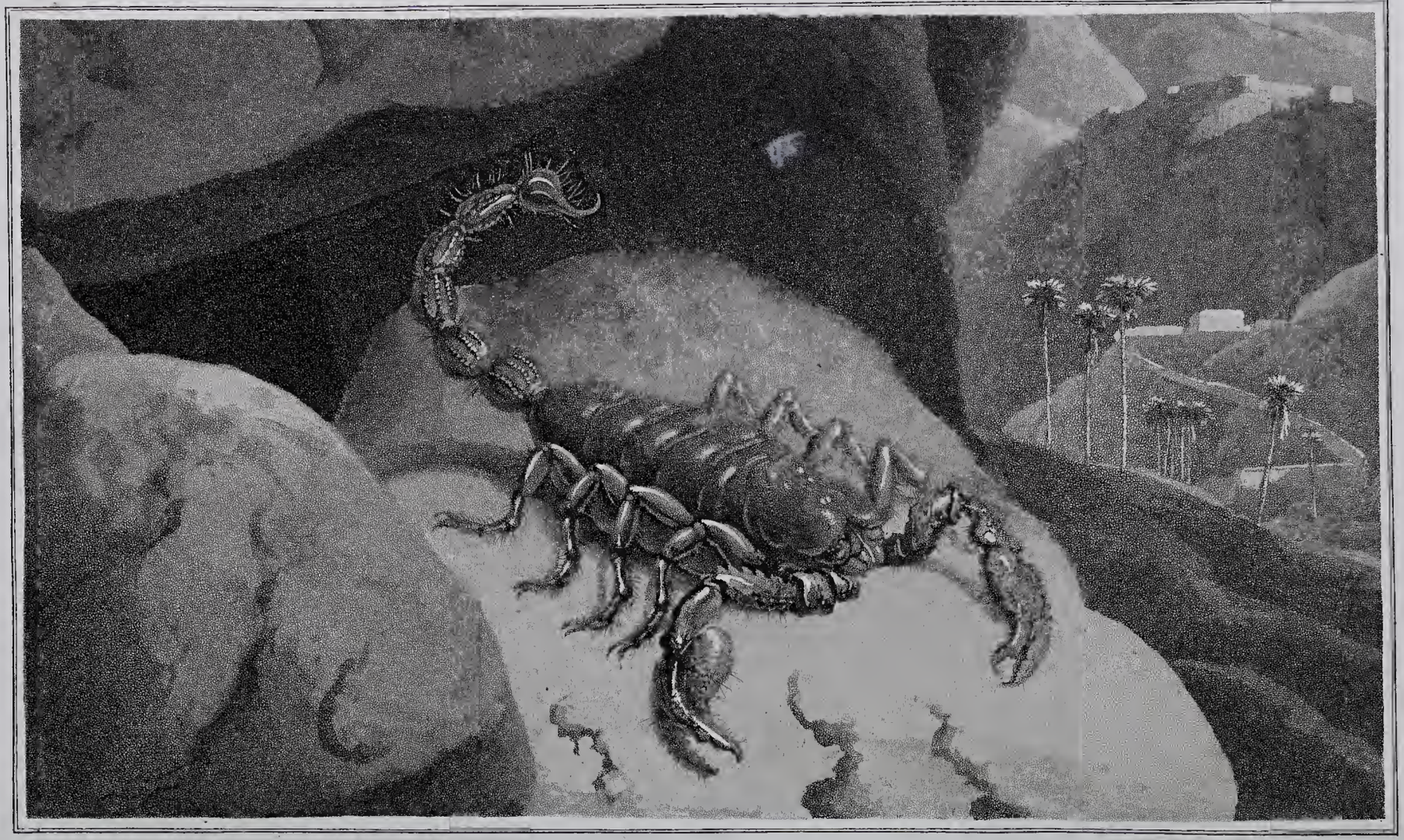
little aquatic insect is not exposed to the immediate action of the water, but is surrounded by a bubble of air, which forms, as it were, a kind of dwelling for the inclosed animal, and gives it a very bright appearance when seen from the surface. It fixes its slender thread to the stalks of the water-plants, and lodges during the winter in a vacant shell, carefully closing the mouth with a slight web.

In many parts of the East Indies and in South America, there is a spider of an enormous size, and of a most hideous appearance. This creature is called the bird-catching spider, *Aranea avicularia*, Linn., from its actually being strong enough to destroy small birds, by first wounding them with its poisoned fangs and then sucking their blood. The whole of this animal's body is covered with brown hair, and the fangs are so large that the slit near the end through which the venom is ejected may be seen without the assistance of a glass. The legs of this spider are as thick as a moderate goose quill, and are terminated by two sharp claws. We may judge how formidable such an insect must be, when we consider that the body including the head is nearly three inches long, and that, when the legs are stretched out, the whole will measure between eight and ten inches. Eight eyes are placed in the front of this creature's thorax, two of which are much larger than the rest. Thus formed for a life of rapacity, the bird-catching spider watches for its

prey among the branches of the trees, and certain destruction awaits the little animal which is unfortunate enough to be entangled in its snare.

We shall here conclude our account of this genus without taking any particular notice of the tarantula, as the stories which have been told respecting the extraordinary symptoms attending its bite, and the wonderful manner in which the patient is cured, are equally without foundation.



SCORPION.

Designed by W. Daniell.

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SCORPION.

GENERIC CHARACTER.

Antennæ none.
Eyes eight.
Two fore feet like the claws of a crab.
Tail long, and terminated by a sharp crooked sting.

SPECIFIC CHARACTER.

Scorpio Afer. .	S. pectinibus tredecim dentatis, manibus subcordatis pilosis. *Linn. Syst. Nat. Gmel.* 1. p. 2961.
	Comb with thirteen teeth, hands slightly heart-shaped and hairy.
	Scorpio Indus. *Degeer Ins.* 7. p. 341. no. 3.
African Scorpion.	*Seb. Mus.* 1. pl. 70. f. 4. *Roes. Ins.* 3. pl. 65. *Shaw Gen. Zool.* 6. p. 486. pl. 130.

There are several species belonging to this genus, but none of them are so remarkable for their size, or the malignity of their poison, as the African kind. This scorpion sometimes grows to the length of ten inches when measured from the end of the claw to the extremity of the tail. The general co-

lour of the body is a dark brown, and therefore not easily distinguished from the rotten wood and furniture under which it lurks. The tail is the instrument which renders this animal so formidable, and the reservoir which contains the poison is situated near its extremity, from whence it is ejected through two very small holes, one on each side the tip of the sting. These holes are so small as to elude the sight of any but an accurate observer. Some have denied their existence, but others, with the assistance of very high magnifying powers, have clearly discovered them. This species is justly dreaded in Africa, where the activity of its venom is frequently productive of troublesome consequences, the symptoms becoming severe, and sometimes ending fatally.

None of the other species are equally venemous, but all are capable of stinging severely, and seem actuated by the same malignant spirit; for they will attack each other with fury if confined in the same glass, and the survivors will devour the conquered. They carry their unnatural temper to a still greater length, and even devour their young if confined during the time of bringing forth. This unnatural propensity was observed by a celebrated French philosopher, who kept one of these animals enclosed in a glass, and saw the young ones devoted to destruction, one after another, till they were all reduced to a single scorpion, which would certainly have shared the same fate, if it had not fortunately taken refuge on the back of the mother,

where it increased in size till it was strong enough to become the aggressor in its turn, and kill the old one.

These animals are viviparous, and bring forth a great number at a time, which at first are white, but soon become of a dusky colour. They are said to cast their skins from time to time, and to live chiefly on worms and insects, with which, if they are well provided, they will live in a state of confinement for a considerable time.

Many idle stories have been told about the scorpion, and some ridiculous remedies proposed to cure the effects of the sting. The most popular of the former is, that when driven to extremity he will destroy himself; and we are very gravely told by those who ought to be superior to such credulity, that a scorpion, surrounded by burning coals, will become so exasperated upon finding it impossible to escape, that he will sting himself on the back of the head and instantly expire.

Scorpions not only frequent the most neglected places, and lurk under rotten wood and stones, but also enter inhabited houses, and sometimes hide themselves about the furniture; it therefore behoves a person, in those climates where they are common, to look carefully about the place where he intends to seat himself, as accidents have frequently happened from carelessness in this respect. The animal is so bold and irascible that he hardly waits to be provoked, and often inflicts his sting before the person is aware of his danger.

CENTIPEDE.

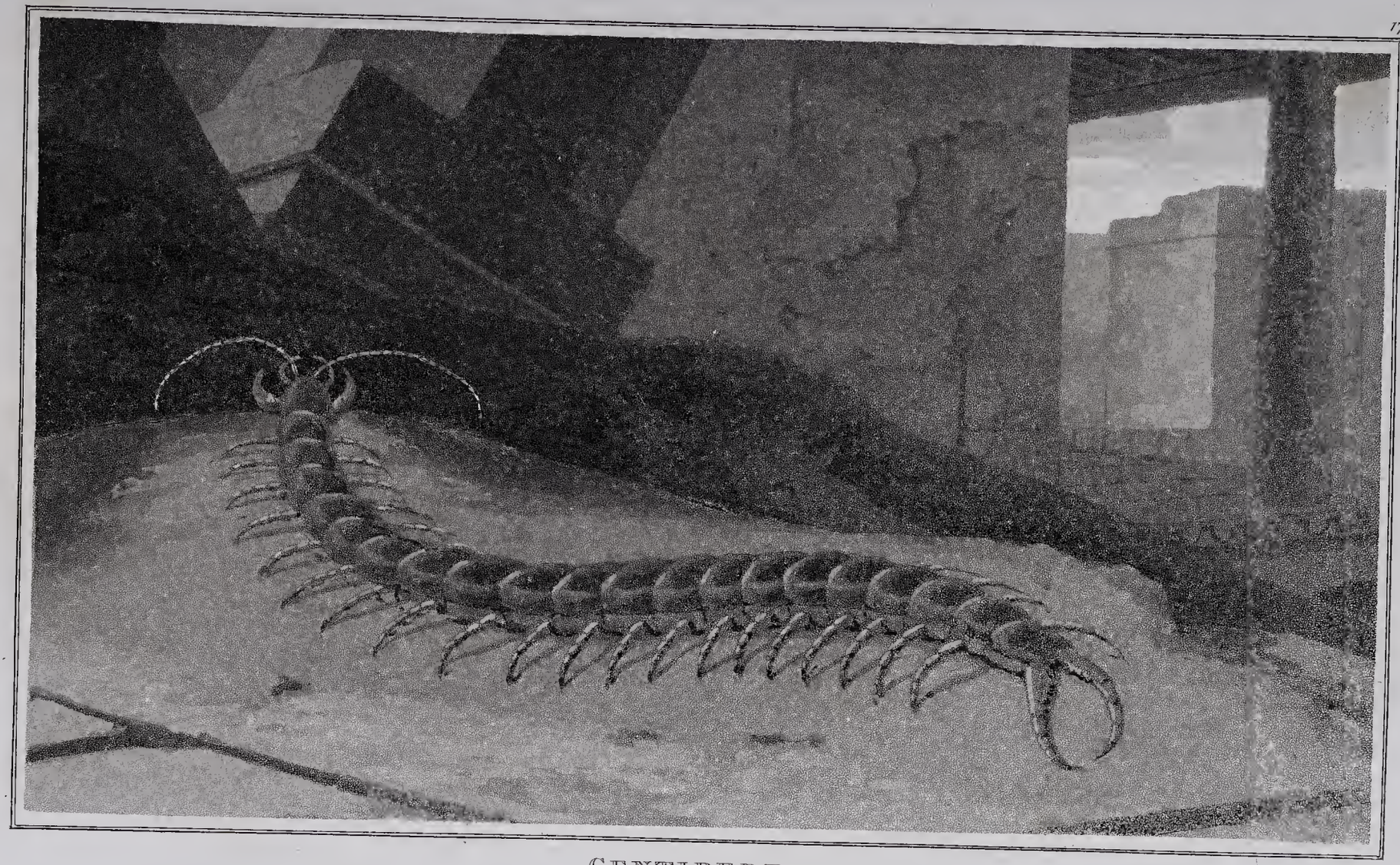
GENERIC CHARACTER.

Antennæ setaceous.
Palpi two, jointed, or formed of many articulations.
Feet numerous; placed on each side of the body, two to every segment.

SPECIFIC CHARACTER.

SCOLOPENDRA MORSITANS.	S. pedibus utrinque viginti, oculis octo. *Linn. Syst. Nat. Gmel.* 1. p. 3016.
	Legs twenty on each side; eyes eight in number.
	JAPURUCA. *Marcgr. Bras.* p. 253.
CENTIPEDE.	*Degeer Ins.* 7. p. 563. pl. 43. f. 1. *Catesb. Carol.* 3. p. 2. pl. 3. *Seb. Mus.* 1. pl. 81. fig. 3, 4. *Shaw Gen. Zool.* 6. p. 503. pl. 136.

THIS is one among the many venemous creatures which infest the warmer parts of the globe, and, except the scorpion, is more to be dreaded than any of the insect tribe. The size of this species of centipede, independent of its sting, would render it an object of terror, since its long body measures nearly ten inches; which, together with its many



CENTIPEDE.

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legs and serrated forceps, give it a very formidable appearance. It is of a yellowish brown colour, and divided into twenty joints, from each of which proceed two legs. A strong curved fang is seen on each side the head, and at the base of each fang is a quantity of poisonous fluid, which the animal ejects through an oblong slit near the apex.

These formidable insects are found in many parts of the East and West Indies; they are likewise frequent in Africa, where they chiefly inhabit the woods. The centipedes would not be dreaded if they confined themselves to their native forests, where the traveller would be prepared to meet them; but this is so far from being the case, that they frequently enter the houses of the inhabitants, and sting them while they sleep. Such indeed is the fear of the people in those particular districts where the centipedes are common, that they place the feet of their beds in vessels of water, to prevent their being attacked by these venemous insects during the night.

The sting of the centipede is excessively painful, and attended with a considerable degree of inflammation; the timely application of sweet oil seems to be as good a remedy as any which has hitherto been made use of to abate the symptoms and relieve the patient. The bite of this creature is instant death to smaller insects, but does not prove fatal to large animals.

CRUSTACEOUS ANIMALS.

CRAB.

GENERIC CHARACTER.

With eight feet, sometimes ten; rarely six.
Fore feet terminated by claws.
Two moveable eyes, generally projecting from the head and placed upon a kind of stalk.
Tail articulated.

SPECIFIC CHARACTER.

CANCER RURICOLA. C. pedum articulo primo spinoso, secundo tertioque fasciculato-pilosis. *Linn. Syst. Nat. Gmel.* 1. p. 2966.

First joints of the legs spinous, second and third with tufts of hair.

Cancer brachyurus, thorace lævi integerrimo: antice retuso pedum articulis ultimis penultimisque undique spinosis. *Syst. Nat.* xii. 2. p. 1040. no. 11.

LAND CRAB. *Sloan. Jam.* 1. pl. 2. *Seb. Mus.* 3. pl. 20. f. 5. *Catesb. Carol.* 2. p. 32. pl. 32. *Degeer Ins.* 7. p. 417. no. 1. pl. 25. f. 1.

THE annual migration of these crabs from the mountains to the sea-shore, in order to deposit their

eggs, is one of the most curious facts in natural history; and if the circumstance was not well attested, we might reasonably deny our assent to the truth of it. Land crabs inhabit the tropical climates in amazing numbers, where their singular manners have been observed by several travellers on whose veracity we may depend. From their observations, collected by an interesting writer, we learn that these animals not only live in a kind of orderly society in their retreats in the mountains, but regularly once a year march down to the sea-side in a body of some millions at a time. They choose the months of April and May to begin their expedition, and then sally forth by thousands from the stumps of hollow trees, from the clefts of rocks, and from the hollows which they dig for themselves under the surface of the earth. All the ground at this season seems alive with them, and according to Lebat they are so numerous that it is almost impossible to prevent treading upon them. They pursue their course to the sea in a right line, from which they never deviate either to the right or left, but pass over any obstacle that it is possible for them to surmount without breaking their line. It is not always, however, that they can preserve their route without interruption; they are sometimes compelled to conform to the face of the country, and to follow the winding of the rivers by which it is intersected. When the procession sets out from the mountains it commonly forms three divisions, of which the first consists of the strongest males,

which march forward to clear the route, and face the greatest dangers. These are often obliged to halt for want of rain, and go into the most convenient encampment till the weather changes. The main body of the army is composed of females, which never leave the mountains till the rains have set in for some time, when they descend in regular order, being formed into columns of fifty paces broad, and three miles deep. Three or four days after this the rear-guard follows, a straggling undisciplined tribe, consisting of males and females, but neither so robust nor so numerous as the former. They chiefly proceed in the night, and halt during the heat of the day; however, if the weather proves wet they take advantage of it, and continue their route without interruption. When any thing alarms them, they march back in a confused disorderly manner, holding up their nippers, which they often clatter together in order to intimidate their enemies. They are disposed to be quarrelsome, and possess the cruel disposition which is common to some of the larger animals; for if any one of the body is maimed in such a manner as to be incapable of proceeding, the rest immediately fall upon and devour it, after which they quietly pursue their march, till they reach the sea-side.

After they have accomplished this fatiguing journey, which it sometimes costs them three months to do, and have arrived at their distant port, they prepare to cast their spawn; and for this purpose go to the edge of the water, and suffer the

waves to pass two or three times over their bodies. Immediately after this necessary ablution is performed, they retire to seek a lodging upon land, and the spawn rapidly increases in size till it is excluded from within the body, and may be seen sticking under the tail, where it is collected into a bunch as big as a hen's egg. In this state of pregnancy they again seek the shore, and shaking off the spawn into the water, leave it to be hatched by the heat of the sun. The fish take advantage of this annual supply, and devour vast quantities of the eggs; but millions still remain to be brought to maturity in the sand, and in due time the shore is covered with little crabs, which soon quit the place of their nativity, and slowly move towards the mountains.

The long march, and the difficulties they have had to overcome, together with the fatigue of spawning, reduce the old crabs so much that they can hardly creep along, and most of them are obliged to remain in the flat parts of the country till they recover. To accomplish this desirable end they dig for themselves holes in the earth, where they live concealed, having carefully stopped the mouth of their caves with leaves and dirt to prevent the access of the air. In these retreats they cast their shells, and continue quite naked and in an apparently torpid state during about six days, when they are said to become so fat as to be delicious food. Soon after this they are seen slowly travelling up to the mountains.

They subsist on vegetables, and seldom venture from their retreats: their habitations may therefore be considered as almost impregnable, as they live in the most inaccessible parts of the mountains, and never go far from home, except when they are impelled by the desire of bringing forth their young to descend towards the sea. At that time the natives wait for them and destroy thousands, but disregard their bodies, and only seek for the spawn which lies on each side the stomach within the shell. They are much more valuable upon their return, when the skin being soft, almost every part of them may be eaten.

They are either taken in their holes by feeling for them with an instrument, or caught by torch-light, in the night, while on their journey. Whenever they are attacked they throw themselves upon their backs, and pinch very severely with their claws whatever they happen to fasten on. But the dextrous crab-catcher, aware of their intention, secures them by the hind legs in such a manner that their nippers cannot touch him, and then throws them into his bag. Sometimes, also, they are caught when they take refuge at the bottom of holes in rocks by the sea-side, by preventing their return till the tide flows and drowns them in their holes. In Jamaica these crabs are found in great plenty, and wherever they appear are of considerable advantage to the poor inhabitants, who almost live upon them during the time they stay upon the coast. They sometimes, however, prove dangerous

food, and are said to poison the persons who eat them: when this happens, it is supposed the animals have been feeding on the manchineel apple; for whenever they are found upon that noxious plant, they are always rejected with caution.

We have a species of crab on our shores whose singular manners have obtained it the name of hermit. This is the *Cancer Bernhardus* of Linnæus, and is found from half an inch, to four inches long. Nature seems to have sported with this creature, and has condemned it to seek that covering which other crabs are provided with from their birth. Being entirely destitute of shell, except upon its nippers, the hermit crab is obliged to seek the empty habitation of a periwinkle, a trochus, or a whelk, which it immediately occupies and continues to reside in, till, by becoming too large for its house, it is under the necessity of changing it. When this is the case, the hermit is seen busily parading the shore along that line of pebbles and shells that is formed by the extremest wave, still, however, dragging its old incommodious habitation at its tail, unwilling to part with one shell, even though a troublesome appendage, till it can find another more convenient. In this search the crab is described as stopping at one shell, turning it and passing it by, going on to another, contemplating that for a while, and slipping its tail from its old habitation to try

on the new. This also is found to be inconvenient, and it quickly returns to its old shell again. In this manner it frequently changes, till at last it finds one, light, roomy, and commodious; to this it adheres, though the shell be sometimes so large as to hide the body of the animal, claws and all. It must be remembered, however, that the crab never occupies an habitation which it cannot readily move from place to place without inconvenience to itself.

This species is armed with strong rough claws, of which the right is the longest; the legs are taper, and the naked tail is furnished at the end with a hook by which it secures itself in its lodging. This animal, in common with other crabs, is very tenacious of its hold, which it will seldom quit till the claw is torn from its body. It is diverting to see these little creatures in search of marine insects, moving their shells about among the rocks which have just been left by the tide.

All the animals of this genus cast their shells at certain seasons, and likewise possess the power of reproduction. The loss of a limb, which frequently happens to these quarrelsome creatures, is of little consequence, as the defect is supplied by the growth of a new member in the course of a few weeks. So conscious are they of this powerful effort of Nature in their favour, that when bruised or maimed in any particular limb, they often cast it off, and retire to a place of safety till the injury is repaired.

Of all the different species of crab, the *Cancer Pisum* is the least. This little creature (as its name

imports) is not larger than a pea; but what renders it of importance, notwithstanding its diminutive size, is the service which it is supposed to render certain shell-fish, by warning them when their prey is at hand. However idle this supposition may be, we can readily excuse it, since it has drawn from the pen of Oppian some very pretty lines, of which the following is a translation.

" In clouded deeps below the pinna* hides,
And through the silent paths obscurely glides;
A stupid wretch, and void of thoughtful care,
He forms no bait, nor lays the tempting snare:
But the dull sluggard boasts a crab his friend,
Whose busy eyes the coming prey attend.
One room contains them, and the partners dwell
Beneath the convex of one sloping shell;
Deep in the wat'ry vast the comrades rove,
And mutual interest binds their constant love;
That wiser friend the lucky juncture tells,
When in the circuit of the gaping shells
Fish, wand'ring, enter; then the bearded guide
Warns the dull mate, and pricks his tender side;
He knows the hint, nor at the treatment grieves,
But hugs th' advantage, and the pain forgives:
His closing shells the Pinna sudden joins,
And 'twixt the pressing sides his prey confines;—
Thus fed by mutual aid, the friendly pair
Divide their gains, and all the plunder share."

* A bivalve shell somewhat resembling a muscle, but considerably larger.

LOBSTER.

SPECIFIC CHARACTER.

CANCER GAMMARUS. C. thorace lævi; rostro lateribus dentato; basi supra dente duplici. *Linn. Syst. Nat. Gmel.* 1. p. 2985.

A smooth thorax; a single tooth on the side of the snout, and a double one above the base.

ASTACUS MARINUS. *Fabr. Sp. Ins.* 1. p. 509. no. 1.

LOBSTER. . . . . *Bast. Op. Subs.* 2. p. 6. pl. 1. *Penn. Brit. Zool.* 4. p. 9. no. 21. pl. 10.

LOBSTERS are found in great abundance on the rocky coasts of this kingdom, and generally inhabit the clearest water. They are caught in traps made of twigs and baited with garbage: these traps are fastened to a cord, and lowered into the sea, the place where they lie being marked by a buoy. They are so extremely prolific, that 12,444 eggs have been counted under the tail of a single female, besides those that remained in the body unprotruded; these are deposited in the sand, where they are soon hatched. While lobsters continue to be so prolific there can be no fear of exhausting the species, though the consumption of them were still

greater than it is. Mr. Pennant received an accurate account of the natural history of this animal from Mr. Travis of Scarborough; and as it contains all the information that can be desired upon the subject, we shall take the liberty to insert it in the words of the author.

"We have vast numbers of fine lobsters on the rocks near our coast. The large ones are in general in their best season from the middle of October till the beginning of May. Many of the small ones, and some few of the larger sort, are good all the summer. If they be four inches and a half long, or upwards, from the tip of the head to the end of the back shell, they are called sizeable lobsters. If only four inches, they are esteemed half size; and when sold, two of them are reckoned for one of size; if they be under four inches, they are called pawks, and are not saleable to the carriers, though, in reality, they are in the summer months superior to the large ones in goodness. The pincers of one of the lobster's large claws are furnished with knobs, and those of the other claws are always serrated. With the former it keeps firm hold of the stalks of submarine plants, and with the latter it cuts and minces its food very dextrously. The knobbed or numb claw, as the fishermen call it, is sometimes on the right and sometimes on the left, indifferently. It is more dangerous to be seized by them with the cutting claw than the other; but in either case, the quickest way to get disengaged from the creature is to pluck off its claw. It seems

peculiar to the lobster and crab, when their claws are pulled off, that they will grow again, but never so large as at first.

" The female or hen lobster does not cast her shell the same year that she deposits her ova, or, in the common phrase, is in berry. When the ova first appear under the tail, they are very small and extremely black ; but they become in succession almost as large as ripe elder-berries before they be deposited, and turn of a black brown colour, especially towards the end of the time of her depositing them. They continue full, and depositing the ova in constant succession, as long as any of that black substance can be found in their body, which, when boiled, turns of a beautiful red colour, and is called their coral. Hen lobsters are found in their berry at all times of the year, but chiefly in winter. It is a common mistake that a berried hen is always in perfection for the table. When her berries appear large and brownish, she will always be found exhausted, watery, and poor. Though the ova be cast at all times of the year, they seem only to come to life during the warm summer months of July and August. Great numbers of them may then be found, under the appearance of tad-poles, swimming about the little pools left by the tides among the rocks, and many also under their proper form, from half an inch to four inches in length.

" In casting their shells it is hard to conceive how the lobster is able to draw the fish of their claws out, leaving the shells entire and attached to

the shell of their body; in which state they are constantly found. The fishermen say the lobster pines before casting, till the fish in its large claw is no thicker than the quill of a goose, which enables it to draw its parts through the joints and narrow passage near the trunk. The new shell is quite membranous at first, but hardens by degrees. Lobsters only grow in size while their shells are in their soft state. They are chosen for the table by their being heavy in proportion to their size, and by the hardness of their shells on their sides, which, in perfection, will not yield to moderate pressure. Barnacles and other small shell-fish adhering to them are esteemed certain marks of superior goodness. Cock lobsters are in general better than the hens in winter; they are distinguished by the narrowness of their tails, and by their having a strong spine upon the centre of each of the transverse processes beneath the tail, which support the four middle plates of their tails. The fish of a lobster's claw is more tender, delicate, and easy of digestion than that of the tail. Lobsters are not taken here in pots, as is usual where the water is deeper and more still than it is upon our coast. Our fishermen use a bag-net fixed to an iron hoop, about two feet in diameter, and suspended by three lines like a scale. The bait is commonly fish-guts tied to the bottom and middle of the net. They can take none in the day-time, when the water is thick and opake; they are commonly caught in the night, but even then it is not possible to take any

when the sea has that luminous appearance which is supposed to proceed from the *Nereis noctiluca*. In summer the lobsters are found near the shore, and thence to about six fathoms depth of water; in winter they are seldom taken in less than twelve or fifteen fathoms. Like other insects, they are much more active and alert in warm weather than in cold. In the water they can run nimbly upon their legs or small claws, and, if alarmed, can spring tail foremost to a surprising distance, as swift as a bird can fly. The fishermen can see them pass about thirty feet, and, by the swiftness of their motion, suppose that they may go much further. Athenæus remarks this circumstance, and says, that the incurvated lobsters will spring with the activity of dolphins. Their eyes are raised upon moveable bases; which enables them to see readily every way. When frightened they will spring from a considerable distance to their hold in the rock; and, what is not less surprising than true, will throw themselves into their hold in that manner, through an entrance barely sufficient for their bodies to pass; as is frequently seen by the people who endeavour to take them at Filey-bridge. In frosty weather, if any happen to be found near the shore, they are quite torpid and benumbed. A sizeable lobster is commonly from one pound to two in weight. There was one taken here this summer* which weighed above four, and the fishermen

* 1768.

say they have seen some which were of six pounds; but these are very rare."

Lobsters are apt to cast their claws on a great clap of thunder, and Mr. Pennant was informed that they will do the same on firing of a great gun. The sailors, it seems, are aware of this circumstance, and, when they meet a lobster-boat at sea, threaten to salute the master unless he sells them good lobsters.

TESTACEOUS ANIMALS.

MULTIVALVE SHELLS.

BARNACLE.

GENERIC CHARACTER.

Shell fixed by its base, and furnished with several unequal erect valves.

SPECIFIC CHARACTER.

LEPAS BALANUS. . L. testa conica sulcata, operculis acuminatis. *Linn. Syst. Nat. Gmel.* 1. p. 3207.
A conical furrowed shell, with a sharp pointed operculum, or lid.
Petits glands de Mer. *Argenv. Conch.* p. 322. pl. 26. f. D. 2. p. 364. pl. 30. f. D.
ACORN FISH. *Dale Harwich.* p. 390.

COMMON BARNACLE. *Penn. Brit. Zool.* 4. p. 72. pl. 37. f. 4. *Da Cost. Brit. Conch.* p. 248. pl. 17. f. 7.

A SHELL so common as the barnacle can hardly have escaped the observation of any one, as it is frequently seen adhering to the shells of our oysters,

muscles, and lobsters; and absolutely encrusts many of the small rocks with which our coasts abound. The shell is of a conical shape, and when perfect is covered by a little lid, which the animal within occasionally raises up in order to admit the sea-water, and collect such food as is congenial to its nature. The shell, like the limpet, is open at bottom, by which part it adheres to the rock, and that with such firmness, that we have frequently found it difficult to separate it even with a knife.

The animals inhabiting these shells are of very singular formation, having twenty-four small tentacula or feelers, which are like so many feathers, and with which they secure the smaller marine insects that serve them for food. Whenever the little animals feel inclined to search for prey, they lift the operculum which covers the shell, and stretch forth their tentacula, which remain fully extended till something of sufficient importance comes in their way; when the barnacle immediately secures the prize, and, sinking into its shell, devours the booty at leisure. Mr. Ellis, who has given a particular account of these creatures in the Philosophical Transactions, has described the tentacula as differing in size, the twelve smallest being placed six on each side of the others; he thinks they perform the office of hands, being more pliable and hairy than the larger ones. They have a trunk or proboscis rising from the middle of the base of the larger claws, and longer than any of them. The animal is able to move this trunk in any direction:

it is tubular, transparent, and composed of rings lessening gradually to the extremity, where it is surrounded with a circle of small moveable bristles. In the inside of this trunk appears the tongue, which is a dark-coloured, spiral substance, that the animal can extend or contract at pleasure. The mouth is placed between the smaller claws, and is not unlike a contracted purse; within the folds are six or eight horny laminæ or teeth. Beneath this lie the stomach and intestines, together with the tendons by which the animal adheres to the shell.

There are several species of this genus, but only one amongst them was ever celebrated for any peculiarity: this was the goose barnacle, *Lepas anatifera* Linn., whose history we have already given in the first volume. This species is frequently found adhering in clusters to the bottom of ships, and to pieces of timber: in this state they are met with in abundance, generally attached to the wood by a short neck; and when in search of food they stretch forth a number of tentacula, which the credulous formerly supposed to be the legs of a bird.

PHOLAS.

Designed by W. Daniell.

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PHOLAS.

GENERIC CHARACTER.

A bivalve shell open at both ends, with several lesser shells at the hinge.

A large incurvated tooth in the inside of the shell beneath the hinge.

SPECIFIC CHARACTER.

PHOLAS DACTYLUS. P. testa oblonga hinc reticulato-striata. *Linn. Syst. Nat. Gmel.* 1. p. 3214.
An oblong reticulated shell.
PHOLAS MURICATUS. *Da Cost. Brit. Conch.* p. 244. pl. 16. f. 2, 2.
PHOLAS HIANS. *Pult. Cat. Dors.* p. 26.
Pholas major striis cancellatis exasperata, subalbida. *Gault.* 1. *Conch.* pl. 105. fig. A. B. C. D.

COMMON PHOLAS. . *Penn. Brit. Zool.* 4. p. 76. no. 10. pl. 39. f. 10. *Argenv. Conch.* pl. 26. f. H. I. *Borlase Corn.* pl. 28. f. 31.

THE animal inhabiting this shell has the faculty, in common with the rest of the genus, of boring a hole in hard clay, or penetrating the firmest wood, where it spends its life in security, and bids defiance to the winds and waves. It is difficult to say how the pholas effects its purpose, since the

body is a soft mass, terminating in a neck which can be exerted at the pleasure of the animal, but not furnished with any visible apparatus for boring of holes. The fact, however, is clear, as they are found in sufficient abundance on the different coasts of this kingdom, and particularly at Salcomb in South Devon, where Mr. Montague found great numbers of them, together with two other species of the same genus, burrowed in the stumps of old trees, which formerly grew there, but are now covered with the tide except at low water. It seems they are taken from their hiding-places by the fishermen, and used with success for baiting their hooks.

The opinion which some persons have advanced respecting the want of power in these animals to perforate hard substances, is thus completely set aside; and yet, when we consider the texture of their bodies, the idea that the pholades entered the stony substance in which they are frequently imbedded, while it was in a soft state, and remained there till it petrified around them, may be excused. It has been remarked that many of the pillars of the temple of Serapis at Puteoli were perforated by these animals. From thence the learned Dr. Bohadsch concludes, that the pholades must have imbedded themselves within them since they were erected; for he very justly observes that the workmen would certainly have rejected any stones for their building, that had been perforated in so many places by these creatures. The pho-

lades must therefore have worked their way into them while they were buried by the influx of the sea, which immediately succeeded the destruction of the city by an earthquake.

There must be something singularly curious in the manner which these creatures pursue to effect such mighty purposes; and we have to regret that while so much attention is paid to shells, so little notice is taken of their inhabitants. Those who live at a distance from the sea may not possess the means of keeping them alive; but the naturalist residing on the coast has it in his power, with ordinary attention, to watch their motions and observe all their curious operations. The subject of our present investigation is highly deserving of notice, as it appears a paradox, that an animal so soft as the pholas should dig itself a dwelling in a stone. If a number of these were kept in a vessel of salt water, and supplied with proper substances to work upon, their operations might be observed, and that which has hitherto justly excited the astonishment of philosophers, would in all probability be explained to their satisfaction.

It has been said that the pholas bores himself a dwelling in the rock while very young, and enlarges it as he increases in size; continually working his way, though by very slow degrees, till his apartment is capacious enough to contain his full-grown body. In this dark chamber he spends his days, perfectly contented with the nourishment

which the sea washes into his dwelling, till he is either dragged from his hole, to be used as a bait for other fish, or dies a natural death in a sepulchre of his own digging. Dr. Maton thinks this must be the case, because the cavity is always smaller at its entrance than the pholas itself.

The shell of the pholas is of an elegant oblong shape, striated transversely, and extending at one end into a beak: a large incurvated tooth appears in each valve; and the length of the shell from one end to the other is from two to four inches.

SOLEN.

Designed by W. Daniell.

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BIVALVE SHELLS.

SOLEN.

GENERIC CHARACTER.

Shell bivalve; oblong; open at both ends.

An awl-shaped tooth turned back in each valve; often double on one side.

SPECIFIC CHARACTER.

SOLEN SILIQUA. S. testa lineari recta, cardine altero bidentato. *Linn. Syst. Nat. Gmel.* 1. p. 3223.

A long, straight shell, having two teeth in one valve, and one tooth in the other.

Solen lævis, albidus, candidus, ex fusco et subroseo colore variegatus et fasciatus. *Gault. Conch.* pl. 95. f. C.

SPOUT FISH. *Martin W. Isles.* p. 6.

RAZOR FISH. *Rutty Dub.* p. 383.

POD SOLEN. . *Penn. Brit. Zool.* 4. p. 83. pl. 45. f. 20. *Da Cost. Brit. Conch.* p. 235. pl. 17. f. 5.

THIS shell-fish is provided with a habitation shaped like the handle of a razor, and therefore admirably calculated to assist the animal in penetrating the sand in which it resides. All the motions of these

little animals are confined to sinking or rising a certain depth in the sand, and many of them may be observed near low water mark with their bodies protruded out of the shell in search of food. When any thing approaches to disturb them, they immediately shrink back, and sink sometimes two feet beneath the surface. A small dimple on the top of the sand marks the place where they are to be found, and betrays them to the fishermen, who either dig them out of the sand with a shovel, or suddenly strike a bearded dart into them. These people chiefly use them for baits, but in Ireland they are said to be eaten, particularly in Lent and Dr. Lister affirms that they are nearly as rich and palatable as the lobster.

None of the species of this genus are capable of moving in any but a perpendicular direction; they are not provided with the means of leaving the spot where they are placed, though they are furnished with a kind of tongue which is greatly assistant to them in their ordinary motions. This useful instrument is fleshy, cylindrical, and moderately long; it is protruded through the end of the shell whenever the animal has occasion to use it, and the extremity is capable of being formed into different shapes: sometimes it assumes the figure of a knob, and at others is moulded into the form of a shovel, terminating in a point. These different appearances in the tongue occur at the pleasure of the animal, and both contribute to assist its motions. With the tongue extended from the inferior

end of the shell, and its extremity terminating in a point, the animal is said to cut a hole in the sand, and afterwards to make it assume the form of a hook, so that it takes a firmer hold, and obliges the shell to descend. In this manner the little workman operates, till by repeated efforts the shell totally disappears. When the animal has occasion to return to the surface in search of food, the other shape becomes of use, and the end of the instrument now assumes the form of a knob instead of a point. With this it presses firmly against the bottom of the hole; and the effect of this muscular effort is to push the shell in a contrary direction, so that by repeating the same the animal at length arrives at the top. Awkward as these shell-fish seem, they contrive to move in this manner with great dexterity.

OYSTER.

GENERIC CHARACTER.

A bivalve shell with a rough scaly coat and cartilaginous hinge.

SPECIFIC CHARACTER.

OSTREA EDULIS. . O. testa semiorbiculata, membranis imbricatis undulatis; valva altera plana integerrima. *Linn. Syst. Nat. Gmel.* 1. p. 3334.
A semiorbicular shell, with the outer coat waved and imbricated; the other valve quite flat.
OSTREUM VULGARE MAXIMUM. *List. Anim. Angl.* p. 176. pl. 4. f. 26, 27.

COMMON OYSTER. *Penn. Brit. Zool.* 4. p. 102. no. 69. *Da Cost. Brit. Conch.* p. 154. pl. 11. f. 6.

THIS well-known shell-fish is dredged up in vast abundance on the different coasts of this kingdom, and has long been celebrated as a delicious and nutritive food. The oysters of our shores were even in request among the Romans; and Juvenal, in satyrizing an epicure, describes his taste as sufficiently acute to discover those from Richborough by their flavour.

In Bishop Sprat's History of the Royal Society, we find the following account of the treatment of

oysters, and of the regulations enforced by the admiralty court respecting the fishery, viz.

"In the month of May the oysters cast their spawn, (which the dredgers call their *spats*,) it is like to a drop of a candle, and about the bigness of a halfpenny. The spat cleaves to stones, old oyster-shells, pieces of wood, and such like things, at the bottom of the sea, which they call *cultch*. It is probably conjectured, that the spat in twenty-four hours begins to have a shell.

"In the month of May, the dredgers (by the law of the admiralty court) have liberty to catch all manner of oysters of what size soever. When they have taken them, with a knife they gently raise the small brood from the cultch, and then they throw the cultch in again, to preserve the ground for the future, unless they be so newly spat that they cannot be safely severed from the cultch; in that case they are permitted to take the stone, or shell, &c., that the spat is upon, one shell having many times twenty spats.

"After the month of May, it is a felony to carry away the cultch, and punishable to take any other oysters, unless it be those of size, (that is to say) about the bigness of a half-crown piece, or when, the two shells being shut, a fair shilling will rattle between them.

"The places where the oysters are chiefly catched, are called the Pont-Burnham, Malden, and Colne waters: the latter taking its name from the river of

Colne, which passeth by Colne-Chester, gives the name to that town, and runs into a creek of the sea at a place called the Hythe, being the suburbs of the town. This brood and other oysters they carry to creeks of the sea, at Brickel-sea, Mersey, Langno, Fingrego, Wivenho, Tolesbury and Saltcoase, and there throw them into the channel, which they call their beds or layers, where they grow and fatten, and in two or three years the smallest brood will be oysters of the size aforesaid.

"Those oysters which they would have green they put into pits about three feet deep in the salt marshes, which are overflowed only at spring tides, to which they have sluices, and let in the salt-water until it is about a foot and a half deep. These pits, from some quality in the soil co-operating with the heat of the sun, will become green, and communicate their colour to the oysters that are put into them, in four or five days; though they commonly let them continue there six weeks or two months, in which time they will be of a dark green. To prove that the sun operates in the greening, Tolesbury pits will green only in summer; but that the earth hath the greater power, Brickel-sea pits green both winter and summer; and for a further proof, a pit within a foot of a greening pit will not green; and those that did green very well, will in time lose their quality.

"The oysters, when the tide comes in, lie with their hollow shell downwards, and when it goes

out they turn on the other side; they remove not from their place, unless in cold weather, to cover themselves in the ouse.

"The reason of the scarcity of oysters, and consequently of their dearness, is, because they are of late years bought up by the Dutch.

"There are great penalties, by the admiralty court, laid upon those that fish out of those grounds which the court appoints, or that destroy the cultch, or that take any oysters that are not of size; or that do not tread under their feet, or throw upon the shore, a fish which they call a *five-finger*, resembling a spur-rowel; because that fish gets into the oysters when they gape, and sucks them out. The reason why such a penalty is set upon any that shall destroy the cultch is, because they find that if that be taken away, the ouse will increase, and the muscles and cockles will breed there, and destroy the oysters, they having not whereon to stick their spat.

"The oysters are sick after they have spat; but in June and July they begin to mend, and in August they are perfectly well: the male oyster is *black-sick*, having a black substance in the fin; the female *white-sick* (as they term it), having a milky substance in the fin. They are salt in the pits, salter in the layers, but salter at sea."

Oysters are said to attach their shells to different substances, so as to secure themselves in the situation where they choose to remain, notwithstanding the agitation of the sea. Rocks, stones, pieces of

timber, or sea-weeds, afford them this security; and it has been asserted that, in the tropical climates, when the trees which grow near the mouths of rivers chance to bend their branches into the water, the oysters frequently hang to them in clusters.

It has been long supposed that oysters have no ability to change their situations, but are obliged for ever to remain in one place. This, however, is not strictly the case, as it has been ascertained that they possess a degree of locomotive power, and occasionally move themselves by ejecting water with considerable force from their shells. This peculiarity in oysters may be observed, says the Abbé Dicquemare, by putting some of them in a plate placed in a horizontal position, which contains as much sea-water as is sufficient to cover them.

MUSCLE.

GENERIC CHARACTER.

Shell bivalve; frequently adhering to some substance by a beard.

Hinge without teeth, the valves being merely united by cartilage.

SPECIFIC CHARACTER.

MYTILUS MARGARITIFERUS.	M. testa compresso-plana suborbiculata, basi transversa imbricata, tunicis dentatis. *Linn. Syst. Nat. Gmel.* 1. p. 3351.
	A compressed suborbicular shell, transversely imbricated at the base, and toothed on the outside.
	MATRIX PERLARUM. *Rumph. Mus.* pl. 47. f. F.
	GALLINA GUTTATA. *Argenv. Conch.* pl. 20. f. A.
PEARL MUSCLE.	*List. Conch.* pl. 221. f. 56. *Gualt. Test.* pl. 84. f. E. F. G. *Chemn. Conch.* 8. pl. 8. fig 717—721. a. b.

THIS muscle has become of consequence on account of the valuable concretion which is occasionally found adhering to the inner coat of its shell:

to procure this precious commodity is the business of a certain class of people, whose wretchedness drives them to risk their lives, in order to support themselves by adding to the magnificence of their superiors.

Pearls are fished for at different places in the eastern parts of the world; one of the principal of which is on the coast of Tinevelly, where a considerable trade is carried on, and several hundreds of vessels employed. The poor wretches who are destined to dive for these jewels, are carried in the muscle boats to the proper station, where a cord is fastened under the arms of each diver, and the end held by the persons in the boat. Every man is furnished with a net or sack, that has the mouth distended by a hoop, and previous to his descent a large stone of considerable weight is loosely fastened to his great toe. Thus provided, he plunges to the bottom, and immediately slips off the stone, which is drawn up by his comrades, while the diver proceeds to fill his sack; and when this task is completed he pulls the rope by which he is secured, as a signal for those in the boat to draw him up.

This is a very dangerous employment, and several lives have been sacrificed in the pursuit of it; not so much from the time they remain under water, as the chance of being either devoured by sharks, or covered by a large flat fish which frequents those seas, and sometimes drowns the adventurer by keeping him under with its immense fins. To guard against these dangers, it is common for the

divers to carry to the bottom with them a sharp knife, with which they defend themselves against the attacks of their enemies.

The boats go four or five leagues from the shore, and fish in twenty or thirty yards depth of water. The divers go down repeatedly in search of muscles, only resting about ten minutes between each time to recover their breath; and in this laborious and painful employment they will continue for twelve hours every day. The shells are laid in heaps till the season is over, and the pearls are sorted according to the size, the very small or seed pearls being sold by the ounce, and those unfit for ornament ground into powder.

The pearls are fished for in the spring of the year in March and April, and in the autumn in August and September. But it is sometimes necessary to allow the muscles to remain for a year untouched, as they will not always produce pearls of sufficient size to make it worth the dealer's while to employ his men. At best it seems but a precarious sort of traffic, as a vast many muscles are often brought to shore before a pearl of any consequence is found.

The Persian Gulf has long been famous for its pearls; and Tavernier mentions the fishery as being very extensive. Many very fine specimens have been brought from thence, whose value increases in proportion to their size and the beauty of their colour. All pearls are subject to become yellow after being exposed to the air for any length of time, and they will likewise decay if kept in a damp

place; probably on account of the saline efflorescence which all marine substances seem liable to in a greater or less degree.

The pearl fishery in the island of Ceylon is particularly noticed by Mr. Percival, who has lately given so good an account of the manner in which the natives obtain the pearls, that we shall beg leave to avail ourselves of his information.

The bay of Condatchy is the spot occupied by the fishers during the pearl season; and this place, which at other times of the year presents nothing but a scene of barren wretchedness, becomes at once all life and bustle: vast numbers of small tents are erected, and people are seen in every direction busily employed about their several occupations. The banks where the fishery is carried on extend several miles along the coast, but the principal bank is opposite to Condatchy, and lies about twenty miles from the shore. Before the people proceed to business, the different oyster banks are surveyed, and a report made on the subject to government. If the oysters are found in sufficient abundance, and have arrived at a proper degree of maturity, the particular banks to be fished that year are put up to the highest bidder, and are usually purchased by a black merchant. The fishing season commences in February, and ends about the beginning of April. The merchant is restricted to a certain term, of which two months is the outside: however, he is sometimes allowed a few days over on account of unavoidable interruptions. The season may be bad;

stormy days may intervene; Hindoo and Mahometan festivals (which are never neglected on any account by the natives) may engage the divers; and many of the people, being Roman Catholics, leave off work on Sundays to attend to their religious duties.

The boats employed in the fishery come from different parts of the Continent, from whence they all repair to Condatchy, where they are numbered and contracted for. During the season all the boats regularly sail and return together. A signal-gun is fired about ten at night, when the whole fleet sets sail with a land breeze. They reach the bank before day-break, and at sun-rise begin fishing. Thus they continue employed till about noon, when the sea-breeze arises and warns them to return home. The owners are informed that the boats are within sight of land by the firing of a second gun. Colours are likewise hoisted, and the anxious merchants repair to the shore to welcome their arrival and take out the cargoes, as it is necessary to have the boats completely unloaded before night. Mr. Percival assures us, that however the day's adventure may turn out, the owners seldom appear to be disappointed; for although they may have been unsuccessful one day, they trust with the greatest confidence to the next, as the Bramins and conjurors, whom they implicitly trust in defiance of all experience, understand too well the liberality of men in hopes of a good fortune, not to promise them all they can desire.

Each boat carries twenty men, ten of whom are employed as rowers and to assist the others who are engaged to dive. They go down into the sea by five at a time, and each set relieves the other alternately, so that by this method the party just come up is allowed time to breathe and prepare for a fresh plunge. Five stones are brought in each boat for the purpose of accelerating the descent of the divers. These stones are of a pyramidal shape, and have a hole through the smaller end, of a sufficient size to admit a rope. The divers, who are accustomed to this employment from their infancy, descend to the depth of from four to ten fathom water, in search of oysters, without the least fear of being drowned. When one of these fellows is about to plunge, he seizes the rope, loaded with a stone, with his right foot, while he takes hold of a bag of net-work with his left *. The diver, thus prepared, takes another rope in his right hand, and holding his nostrils with his left, plunges into the water, and immediately sinks to the bottom. He then hangs the net round his neck, and collects as many oysters as he can while he remains under water, which is usually about two minutes. He then makes a signal to those above, who draw him up, while the stone is left at the bottom to be pulled up afterwards by the rope attached to it.

* It appears from Mr. Percival's account, that all the Indians use their toes in working or holding as well as their fingers, and that from habit they can pick up even the smallest thing from the ground, with their toes, as nimbly as an European could with his fingers.

It seems the exertion which these poor wretches undergo, during this process, is so violent, that upon being brought into the boat, they discharge water from their mouth, ears, and nostrils, and frequently even blood. We must suppose this often to be the consequence of their labour, since we are told they will make from forty to fifty plunges a day, and at each plunge bring up about a hundred oysters. The usual time of remaining under water does not exceed two minutes; but instances are known of divers who could continue four or five minutes; and Mr. Percival mentions an instance of a diver from Anjango, who, in the year 1797, absolutely remained at the bottom full six minutes.

Here, as well as in other fisheries, the ground-shark is the chief object of terror to the divers. The element into which they daily plunge is natural to them; they may be considered as almost amphibious, and go from the surface of the water to the bottom, with as much unconcern as an European would walk in his garden; but they are far from being insensible of danger from this inhabitant of the deep, and the fear lest they should meet with their terrible enemy, so continually occupies their minds, that these simple people seek for safety in supernatural means. " Before they begin diving," says Mr. Percival, " the priest or conjuror is always consulted; and whatever he says to them is always received with the most implicit confidence. The preparation which he enjoins them consists of

certain ceremonies, according to the cast and sect to which they belong, and on the exact performance of these they lay the greatest stress. Their belief in the efficacy of these superstitious rites can never be removed, however different the event may be from the predictions of their deluders. Government therefore wisely gives way to their prejudices, and always keeps in pay some conjurors, to attend the divers and remove their fears. For though these people are so skilful and so much masters of their art, yet they will not on any account descend till the conjuror has performed his ceremonies. His advices are religiously observed, and generally have a tendency to preserve the health of the devotee. The diver is usually enjoined to abstain from eating before he goes to plunge, and to bathe himself in fresh water immediately after his return from the labours of the day.

"The conjurors are known in the Malabar language by the name of *Pillal Karras*, or *binders of sharks*. During the time of the fishing, they stand on the shore from the morning till the boats return in the afternoon, all the while muttering and mumbling prayers, distorting their bodies into various strange attitudes, and performing ceremonies to which no one, not even themselves I believe, can attach any meaning. All this while it is necessary for them to abstain from food or drink, otherwise their prayers would be of no avail. These acts of abstinence, however, they sometimes dispense with,

and regale themselves with *toddy*, a species of liquor distilled from the palm-tree, till they are no longer able to stand at their devotions."

It appears that these conjurors are an artful set of people, and that while they are deluding the poor divers, they are not unmindful of their own interests, but endeavour, by every means in their power, to steal the pearls. Of course the superintendant of the fishery, who is well aware of their intentions, looks upon them with a jealous eye; but from the great attachment of the people towards these men, he is obliged to conceal his suspicions, and acknowledge their power over the sharks. The artful manner in which these fellows recover their credit with their superstitious votaries, when by any chance they have failed in their predictions, is thus related by Mr. Percival:

"Since the island came into our possession, a diver at the fishery one year lost his leg, upon which the head conjuror was called to an account for the disaster. His answer gives the most striking picture of the knowledge and capacity of the people he had to deal with. He gravely told them, 'that an old witch, who owed him a grudge, had just come from Colang on the Malabar coast, and effected a counter-conjuration, which for a time rendered his spells fruitless: that this had come to his knowledge too late to prevent the accident which had happened, but that he would now show his own superiority over his antagonist by enchanting the sharks and binding up their mouths, so that no more

accidents should happen during the season.' Fortunately for the conjuror the event answered his prediction, and no further damage was sustained from the sharks during the fishery of that year."

The divers are paid either in money, or with a portion of pearl oysters, which they take the chance of opening on their own account. The boats are hired in the same manner; and the spirit of speculation, which has charms in all countries, makes them prefer the most uncertain method of the two. Many pearls are stolen by the persons employed to search the fish, who are sometimes suspected of swallowing them: when this is supposed to be the case, the merchants confine the men and give them strong emetics and purgatives, by which the stolen goods are said to be frequently discovered.

When the oysters are removed from the boats, they are placed in pits about two feet deep, or in small square places fenced round for the purpose, and there suffered to die and rot. The stench occasioned by them, while passing through a state of putrefaction, is so great as to infect the air for a considerable distance round the place where they lie: but this must be endured for the sake of the pearls, which might be greatly injured if the oysters were opened by force while they were alive.

The black people are very expert in drilling and stringing the pearls which have been found during the season. Mr. Percival, who was much pleased with their dexterity, tells us that they use a machine made of wood, resembling an obtuse inverted

cone, and supported upon three feet. In the upper flat surface of this small machine, holes are formed to receive the larger pearls; those of a small size are beat in with a little wooden hammer. The drilling instruments are spindles turned round in a wooden head by means of a bow handle to which they are attached. The pearls being placed in the holes already mentioned, and the point of the spindle adjusted to them, the workman presses on the wooden head of the machine with his left hand, while his right is employed in turning the bow handle. He occasionally moistens the pearl, to accelerate the process, by dipping the little finger of his right hand in a cocoa-nut-shell filled with water, which is placed by him for that purpose. This is done with a dexterity and quickness which can only be acquired by long practice*.

It is supposed that the pearl is a morbid concretion, formed in the shell by the animal while in an unhealthy state; and that the jewels will be larger or smaller in proportion to the strength of the disease. The calcareous matter of which it consists is deposited in the same manner as the internal surface of the shell; that is, one layer upon another; so that, when cut through the middle, the different coats may be traced from the centre of the pearl to its circumference.

Linnæus made a remarkable discovery relating to

* Mr. Percival has related several other interesting circumstances respecting the pearl fishery, for which we must refer our readers to his Account of the Island of Ceylon.

the formation of pearls in the river pearl muscle (*Mya margaritifera*) which, though a different shell, and belonging to another genus, may be mentioned in this place on account of this singular circumstance. It appears that Linnæus (by some means, of which we are totally unacquainted,) contrived to put these muscles into a state of producing pearls at his pleasure, though the final effect did not take place for several years. It was supposed, from a paper which was published many years after the discovery by Chemnitz, that the method consisted in injuring the shell externally, perhaps by a perforation; for it has been observed that these concretions, in the fresh water muscle, are found in the inside exactly opposite to the perforations and injuries made by *serpulæ* and other animals. However this may be, the states of Sweden thought the subject of sufficient importance to reward Linnæus with a premium of 1800 dollars, which is equal to about 450 pounds sterling. This curious discovery is more particularly noticed in the General View of the Writings of Linnæus, edited by the learned Dr. Maton; where the reader will find the translation of a very interesting memorial, which was laid before the states for the purpose of enforcing Linnæus's claims on this occasion.

It has been long known that this species of fresh water muscle occasionally produces pearls, and mention is made in Lowthorp's Abridgement of the Philosophical Transactions, of several of large size found in the rivers of the county of Tyrone and

Donegal in Ireland. Single pearls were sold from four pounds ten shillings to ten pounds, and one, considered however as an extraordinary instance, weighed thirty-six carats, and was valued at forty pounds, but being foul lost much of its worth.

But it is not the muscle alone which produces this beautiful ornament; other shell-fish will sometimes deposit the same substance; and we lately saw a pink pearl which was taken from the body of a very large kind of whelk*, which is fished up by the Negroes off the island of Barbadoes, and sold in the markets as a delicacy. This beautiful prize was discovered by chance, while the men were employed in cleaning the fish. It weighs twenty-four grains, and would have been more valuable if it had been of a round shape. Only four of these pearls have been discovered in the vast numbers of shell-fish that are annually brought to market in that part of the world, though we have reason to believe that this is in some measure owing to carelessness in the Negroes, who clean their fish without consideration, and have probably in their hurry returned many a pearl to its native element along with the refuse of the animal. It should be remarked that the pearl is exactly of the same colour as the interior coat of the shell, and is like it in every respect except in figure.

We must now leave these precious shells to descend to the common muscle, which, notwithstand-

* *Strombus Gigas* Linn.

ing its humble situation, and inability to produce any thing worth the notice of the jeweller, affords something in its history worthy the observation of the naturalist. Nature is not inattentive to the wants even of the most insignificant of her productions; and therefore the muscle, which ranks so low amongst the inhabitants of the deep, has not been forgotten. This helpless animal would be subject to be dashed against every rock, and broken into fragments by the rude motion of the waves, if it were not for an anchor with which she is naturally provided, and which, when once thrown out, enables her to ride out the greatest storms in safety. The instrument of motion by which the muscle contrives to reach the object it wants to bind itself to, is a muscular substance resembling a tongue, which is found long in proportion to the size of the animal. In some it is two inches long, in others not a third part of these dimensions. This the creature has the power of thrusting out of its shell; and with this it is capable of making a slight furrow in the sand at the bottom. By means of this furrow it can erect itself upon the edge of its shell, and thus continues to make the furrow in proportion as it goes forward. The progressive motion of the shell is effected by the tongue, which is stretched forward and drawn in alternately, and being of a glutinous nature, attaches itself to the sand, so as to move the shell by slow degrees, till it reaches the destined point. Having determined upon its place of residence, the muscle detaches a number of

threads from its body, with which, as with a cable, it fixes itself to the stone or rock, and thus resists all the agitations of the water. These threads are called the beard of the muscle, and are a very curious appendage to the animal, which, secured in this manner, finds a ready subsistence in the little particles of animal matter, and the small marine insects which the sea washes into its shell.

Muscles are considered as delicate food, and are very commonly eaten, but not always with impunity. Some constitutions seem to be much affected by these shell-fish, and many people are said to be poisoned by them. It is difficult to account for this, as some persons will be seized with very unpleasant symptoms, such as swellings, shortness of breath, and even convulsions; while others, who have been eating from the same dish, will escape unhurt. As the mind, upon these occasions, is always active to discover a cause, and will rather put up with a doubtful one than have none at all, the poor little pea-crab has been fixed upon as the author of the mischief, though he is perfectly harmless, and only now and then craves an asylum within the gaping shells of the muscle. The best remedy to remove the bad effects arising from these fish, is an emetic taken immediately, and, after its operation, a dose of castor oil.

PAPER NAUTILUS.

GENERIC CHARACTER.

A thin ribbed shell with a large single cavity.

SPECIFIC CHARACTER.

ARGONAUTA ARGO. A. carina utrinque subdentata. *Linn. Syst. Nat. Gmel.* 1. p. 3867.
Keel a little toothed on both sides.
NAUTILUS TENUIS. *Rumph. Mus.* pl. 18. f. 1, 4. A. B.
NAUTILUS PAPYRACEUS. *Argenv. Conch.* pl. 5. f. A. B. C.

PAPER NAUTILUS. *List. Conch.* pl. 554, 555. *Seb. Mus.* 3. pl. 84. f. 4—12.

THIS shell is one of the most elegant of the whole tribe, and is remarkable for the thinness of its substance; it is of a pure white, except a slight tinge of yellow within the shell, and the sides are marked with elegant ribs that run towards the keel. This little vessel has a sailor within who has been much

PAPER NAUTILUS.

Designed by W. Daniell.

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celebrated for his skill in navigation, and is even supposed to have suggested the first idea of that art amongst the ancients.

In the Mediterranean Sea, and in the Indian Ocean, these shell-fish are not uncommon. In calm weather they may be observed floating on the surface in a very beautiful manner, some spreading their little sails, while others are rowing with their feet. To accomplish this singular purpose the nautilus is supplied with eight arms, two of which are furnished at their extremity with an oval membrane that serves for a sail, while the other six, hanging over the sides of the boat, are employed as oars, and occasionally serve to steer by. In order to rise from the bottom of the ocean for the purpose of sailing on the surface, the nautilus discharges a quantity of water from its shell, by which it becomes lighter than the surrounding medium, and of course rises to the top. Numbers of these curious animals may be seen sailing about and diverting themselves on the smooth surface of the sea; but if any danger approaches, or the winds begin to rise, they immediately lower their sails, and, shrinking into the body of the shell, sink at once to the bottom. Their extreme timidity makes it very difficult to take them alive; for, whenever any person approaches, they immediately leave the surface of the water; and although seamen have often got very near them, yet when they arrived within a certain distance and stretched out their hands to secure the fish, they

constantly disappointed the person by sinking to the bottom.

The argonaut or paper nautilus is of a distinct genus from the common or chamber nautilus. This is a much thicker shell, and contains an animal of very different habits. Unlike the paper nautilus, it is divided into a number of chambers, each separated from the other by a beautiful mother of pearl partition, having a small hole about the size of a crow-quill in the upper part. Each chamber is filled by the body of the animal, and a communication kept up between the head and the tail by a vessel which runs through the small opening in each partition. Thus, when the fish is removed from its shell, it appears like a number of small bits of flesh threaded together by a common membrane.

COWRY.

GENERIC CHARACTER.

Shell univalve; of an oval shape, and blunt at each end. Aperture the length of the shell, and toothed on each side.

SPECIFIC CHARACTER.

CYPRÆA TIGRIS. C. testa ovata, posterius obtusaa, nterius rotundata: linea longitudinali testacea. *Linn. Syst. Nat. Gmel.* 1. p. 3408.

Of an oval shape, obtuse on the posterior part and rounded before. A longitudinal line along the top of the shell.

PORCELLANA GUTTATA. *Rumph. Mus.* pl. 38. f. A.

TIGER COWRY. *List. Conch.* pl. 681, 682. f. 28, 29. *Gualt. Test.* pl. 14. f. G. H. I. L. *Argenv. Conch.* pl. 18. f. F. *Mart. Conch.* 1. pl. 24. f. 232—236.

THE species belonging to this genus are, for the most part, remarkable for their beauty, and the particular one which we have selected may truly be said to rank amongst the first in point of elegance. Notwithstanding the richness of its colouring and the softness of its tints, this beautiful shell has shared the fate of many a common object: it is com-

paratively disregarded; and whilst others of very inferior beauty are carefully treasured in cabinets, this species is only thought worthy to grace a mantle-piece. The *Tiger Cowry* is too well known to require a particular description of its form or colour; it will suffice to say that its rich enamelled back is covered with black spots, which often run together and form small patches; that the sides near the mouth are white, and sometimes prettily pencilled with gray lines, and that a line runs obliquely along the back.

What makes the subject of our present attention particularly interesting, is the history of the manner in which it is formed by its tender inhabitant, and the peculiar power which the animal has of quitting its shell whenever it becomes inconvenient, in order to construct a new dwelling of more capacious dimensions.

We learn from M. Bruguière, who has published his observations (*Sur la Formation de la Coquille des Porcellaines, et sur la Faculté qu'ont leurs Animaux de s'en détacher, et de les quitter à des différentes Epoques*) in the first volume of the *Journal d'Histoire Naturelle,* that the inhabitant of the cowry, independent of the organs which are common to animals of other univalve shells, has two ample membranaceous appendages, or wings, placed on the sides of the body, with which the creature can completely cover itself. These two wings contribute greatly, together with the edge of the neck or collar of the animal, towards the formation of the shell; since

they furnish the ordinary exterior layers of enamel, upon which we may perceive the marks of the laminæ or successive coats of which all shells are composed. The shape of the exterior layers is different from those situated beneath, which may be considered as a smooth shining substance that the animal goes over once while it is forming its shell in order to give it the necessary solidity. It is from the body of the animal, or from the edge of its collar, that the inferior part of the shell is formed, or rather the testaceous mould. This mould is generally thin and very brittle: it is striated longitudinally; and as its origin is not different from that of other shells, it is not surprising that we find proofs of the formation in the regular projections which the extremities of the layers leave by the side of each other. The colours of the mould are different from those of the exterior layers, and it frequently shows the transversal bands with which it is marked, whilst the enamel is adorned with spots or stains, because some parts of the body of the animal are disposed to furnish this composition, which is secreted from certain moist glands of a different kind from those of the wings.

Thus we remark two distinct operations in the formation of a cowry: the first is that which produces the part of the shell which we have called the mould, and is the result of a secretion from the body of the animal; the second, the formation of the shining enamel. The cowries are thin and transparent in the first stages of their growth, but at length

acquire solidity by means of the external layers, which the animal applies after the mouth is not only formed, but considerably contracted, and furnished with the rudiments of teeth. The last coats proceed, as we have already said, from a transudation from the wings of the animal, and leave upon the convex surface of the shell the marks of the manner in which they are formed. This is by a longitudinal line, which may be plainly seen, and which divides them into two unequal parts. This line (made by the junction of the wings of the animal) plainly indicates, by the faintness of the tint, that the colouring juice was wanting in this part. It is a simple straight line, when the edges of the wings are of the same configuration, but passes in a sinuous or waving direction, as in the *Cypræa mappa*, when the same edges are fringed or irregularly cut in their contours.

The most interesting part of the history of these animals, and what may be considered as a very singular phænomenon, is their ability to quit their shells when they are no longer capacious enough to contain them, and to construct others better suited to their purpose. The animal increases in size while it is completing its shell, till at length it grows too large for its habitation, which, when finished, no longer admits of enlargement. Thus straitened for room, it is obliged to quit its old dwelling and build a new one of larger dimensions, and better proportioned to the increased size of its body. We are at a loss to say how this operation is performed; but we may suppose it is not a very laborious one, since

the body of the animal is of a consistence between the tendinous and the mucilaginous; of course not making any great resistance to its passage through the mouth of the shell; for the foot and the two wings, which compose by far the largest part of the body, slip out in a moment with the greatest ease. This separation of the animal from its shell is not difficult to conceive, when we consider how readily the lobster quits its crustaceous covering, and the crab gets rid of its claw.

When the cowry has completely abandoned its shell, it is quite naked, and exposed to the immediate influence of the saline element by which it is surrounded. From the irritation occasioned by the action of the sea, or from some other cause of which we are ignorant, the hinder parts of the body again begin to furnish the testaceous matter, which is afterwards condensed upon the surface. This secretion is continued till at length the shell appears of the consistence of paper, and the mouth, which at this period is very wide, soon afterwards contracts to its proper shape. The wings of the animal, folded upon its convex surface, thicken and form the teeth, which are seen on the edge of the mouth, and which are deposited with the enamel that adorns the external part of the shell. In this manner is produced the opaque and highly polished surface which is so eminently beautiful in the full-grown cowry, and which, by the colour of its spots or stains, contributes greatly towards distinguishing the different species of the genus.

TESTACEOUS ANIMALS.

SNAIL.

GENERIC CHARACTER.

A spiral shell, sub-pellucid and brittle.
Mouth of a semilunar shape.

SPECIFIC CHARACTER.

HELIX HORTENSIS. H. testa imperforata globosa; labro albo. *Linn. Syst. Nat. Gmel.* 1. p. 3649.
A globose imperforated shell, with a white lip.
Cochlea vulgaris major pulla maculata et fasciata hortensis. *List. An. Ang.* pl. 2. f. 2.
COCHLEA VULGARIS. *Da Cost. Br. Conch.* p. 72. pl. 4. f. 1.

GARDEN SNAIL. . *Penn. Br. Zool.* 4. p. 136. no. 129. pl. 84. fig. 129. *Montague Test. Brit.* p. 408.

THE shell of the snail possesses two advantages of essential service to its weak inhabitant; for it is at once extremely solid and uncommonly light: thus is the animal protected from injury, and at the same time enabled to remove with its house wherever it

pleases. The young snail, when first excluded from the egg, is completely formed, with a shell upon its back of a minuteness proportionable to that of the body, and of the dimensions of the egg which enclosed it. The first shell is extremely thin, and proves the basis of a second, which is perpetually increasing; and the little shell, such as it is at its eruption from the egg, will always be the centre of the other, which the animal, advanced in her growth, forms and completes by adding new circles to the first shell: and as her body can only be extended towards the aperture, this must consequently be the part that receives the fresh accessions, the materials of which are lodged in the body of the animal, and formed by a liquor or viscous fluid of considerable tenacity. This glutinous secretion is transmitted through a great number of little channels, to the pores with which the whole surface of the body is perforated, and thickens into a consistence round the mouth of the shell. It is here drawn out into a thin film, under which a second is soon after extended, and this proves a covering to a third. From the union of these three films results an incrustation of the same quality with the rest of the shell. When the animal increases in bulk, and the extremity of its body is not sufficiently covered, it continues to secrete the materials, and build in the same manner. By these means it erects and repairs its habitation.

To prove that this secretion is constantly used for the purpose above mentioned, several snails were

procured, and part of their shells broken off without bruising the animals. In this state they were enclosed under glasses, and accommodated with a proper quantity of earth and green leaves. That part of the body which became visible by the fracture of the shell, was immediately covered with a kind of froth that flowed through all the pores, and was soon succeeded by a second evacuation, which gradually raised the first to a level with the old shell. That this juice flows from the body of the animal, and not from the extremities of the adjoining shell, is rendered sufficiently clear by the following experiment. The little skin which grows under the shell of a hen's egg, was carefully inserted between the body of the snail and the extremity of the fracture. If the shell had then contributed to its own reparation, the juice that would have flowed from it must certainly have been shed over the little skin, and had covered it in proportion as the cavity closed. On the contrary, if the fluid proceeded from the body of the snail, this skin would have prevented its effusion to the shell, and in this case, the juice would settle between the cuticle and the body of the animal; which, in reality, happened to be the fact.

Although this experiment accounts for the formation of the shell in a satisfactory manner, yet another difficulty remains to be cleared up. If the shells are formed in the manner we have described, and the fractures they receive are repaired by a matter that passes through the very same perforations that originally ejected the substance of the shattered

covering, the new piece that fills the vacancy should exactly tally in colour with the old fragment, as well as with all the rest of the shell; and yet several snails repair their shell in such a manner that the additional piece will be of a different colour from the rest. This circumstance, as well as the streaks and clouds which we admire on the shells of these animals, is supposed to proceed from the different disposition of the extreme parts of the creature's body, that are visible at the aperture of the shell, where we may frequently discover some minute lobes or lines of flesh, that differ from the rest in colour. This variety leads us to believe that they have a different texture from those that are contiguous, and consequently the juices that flow into them, passing through strainers, whose perforations vary from those of the adjoining parts, acquire a particular complexion in that place; and as these lobes perform their functions and evacuations as well as the others, and, in the successive formation and enlargement of the shell, contribute their proportion with the rest of the shelly substance that is from time to time thrust out, all the points of the old shell that correspond with them must inevitably assume the same colour, and which differs from that of the surrounding parts: consequently these colours must be drawn out, and distributed into lines and rays, and continued in the same manner as long as the animal persists in her gentle motions, and makes new additions to her shell, by the repeated protrusions of her body.

This process may perhaps be rendered clearer by

observing, that as the animal increases in growth, it draws its tail from the bottom of the shell; that, having become too little for its reception, it then ascends higher, and fixes its tail near the second or third contortion of the shell, and enlarges its apartment at the opening. As it makes these advances by little and little, and ascends from point to point, as they lie contiguous to each other; those parts of its body in the aperture of the shell, that by the diversity of their pores cause this variation of colour, form one continued and regular streak: but when the animal, in changing its situation, leaves an interval between the point from whence the tail is removed, and the new one to which it is fastened, all the other parts of the body move in the same proportion; and those in the orifice of the shell, that impress the stains, being transferred to some distance from the preceding speck, tinge the shell so, as to leave a space of more or less extent between each spot. A thousand accidents may likewise intervene to heighten or diminish certain tints, and diversify the whole to infinity.

Snails have four horns, which are distinctly visible while the animal is in motion. The eyes appear at the extreme ends of the two uppermost horns like blackish points, and their situation is admirably calculated to assist the animal in discovering surrounding objects, as they resemble two lenses placed at the end of flexible tubes, which are capable of being moved in any direction. The mouth is seen beneath the lower pair of horns, and is provided

above with a palate and a callous jaw, to which is firmly fixed a tooth shaped like a crescent, and terminated by a number of sharp points like so many minute teeth: with these the animal chews its food, and makes great havoc among the leaves of our garden plants. A little tongue is seen in the lower part of the mouth provided with a hard substance at the extremity.

Nature has supplied the want of feet in the snail by providing the animal with two large muscular skins on each side of the body, which can be contracted or extended at pleasure. The snail is likewise prevented from falling by a viscous humour with which the lower part of its body is covered, and which enables it to adhere very tenaciously in any situation.

But the most singular circumstance in the natural history of these animals, and that which requires all our faith to believe, is the peculiar manner in which they carry on their courtship; for, while the poets are content to wound their heroines with imaginary darts, the snails are said to use the real ones, and we are gravely told that when they are disposed to approach each other, they signify their mutual inclination in a manner peculiar to themselves; one lanches against the other a kind of little dart, which has four wings, or minute edges. This weapon flies from the animal who shot it, and either lodges in the other, or falls down by her after making a slight wound, upon which this creature in her turn dispatches another dart at the aggressor; and thus

the combat continues for a short time, when a reconciliation ensues, and the lovers come together. It appears that the animals are stocked with these darts at the seasons when they feel inclined to approach each other, and that after these combats they lay a certain number of semitransparent eggs about the size of small peas, in some moist situation, generally under the earth, where they lie concealed till the young snails are brought forth.

Mr. Montague, in his *Testacea Britannica*, has glanced at this peculiarity in the snail without giving much credit to the accounts of other authors respecting the circumstance. He admits that snails possess small testaceous spiculæ at certain seasons, but seems to doubt their being missile darts, though it is natural to suppose the animals are furnished with them for the purpose of stimulating each other to love, because it is only at that season they are found to possess them. "If such are ever discharged at each other," says this gentleman, "we have been extremely unfortunate in our observations, for in no one instance could we ever find the dart penetrated; though at the time the animals are close the point may irritate: but it is neither sufficiently strong nor sharp-pointed to penetrate the tough skin with which these animals are furnished; and, indeed, the extremely viscid secretion with which they are so copiously provided, adheres so strongly to these spiculæ, when wholly projected from the body, that they are for a time held by it. These celebrated love-darts are sub-pellucid, white, and

very brittle; about a quarter of an inch, or three eighths in length, and somewhat triangular, like the blade of a sword."

Dr. Maton has often observed these spiculæ, but never saw them actually projected from one to the other.

Snails retire into holes or other sheltered places at the approach of winter, where they cover the mouths of their shells with a glutinous operculum, or lid, and remain in a torpid state till the genial warmth of the following spring tempts them abroad again. The long fast which they sustain during the winter season, reduces their size, and renders them so voracious on their first coming forth, that almost any green vegetable is relished by them, and consumed with the greatest avidity. When moist food is not to be obtained, they will even eat dry substances, and have been known, when confined for a single night under a glass of more than four inches diameter, placed on a sheet of common blue paper, entirely to devour the whole of the paper contained in the included space, to the very edge of the glass.

Snails are said to be exceedingly tenacious of life, and some wonderful accounts have been published to prove this quality. Among them, we find the history of some, which, after having been known to remain about fifteen years shut up in a cabinet, came to life again upon being immersed in water! and of others which stood a boiling twice repeated, and yet were none the worse for it the next morning. That we may not, however, make the thing

appear still more extraordinary than it is, it will be necessary to state exactly how this was done. The person who relates the circumstance in the Annual Register, collected the snails in order to decorate a grotto; and, being of a merciful disposition, was resolved to put them to death at once, instead of sticking them up alive against the wall. To accomplish her purpose (for the author of this account was a lady), she procured a large china bason, and putting a handful or two of snails into it, filled the vessel with water from a boiling tea-kettle. After a short time this water was poured off; and to prevent the possibility of returning animation, the bason was again filled in the same manner, and left to stand till the morning; when, to the very great astonishment of the lady, she found her snails crawling about, some on the edge of the bason, some tumbling over, some on the table, and one or two actually eating the paste that was to stick them on! It appears that the lady was perfectly shocked; she cried, picked up every snail carefully, carried them into a field beyond the garden, and gave them all their liberty.

Among the Abbé Spallanzani's Tracts on animal reproduction, we find some curious though cruel experiments relative to the common snail, which possesses the power of renewing certain parts of its body, that may have been separated either by accident or design. The Abbé first began by cutting off one of the animal's horns, which was seen to bud again in about twenty-five days, and continued to

grow till it was equal in length to the other. He next proceeded to take off part of the head, which was attended with the same success; for in course of time the parts were reproduced, and the animal became as perfect as ever. This was not always the case when the whole head was removed; but even under this unfavourable circumstance the animal often recovered, and appeared at the end of a few months with a new head in every respect equal to the old one. The Professor tells us that he tried this experiment on a great many snails, and that they retreated into their shells the moment after the operation, where they concealed themselves, and remained for many weeks, and even months, covering the mouth of their habitation with a whitish operculum, produced by the tenacious matter which exudes from the body. When forced to come out in thirty or forty days, for the purpose of examining their wounds, the naked trunks of some appeared without any marks of reproduction; but others, if the weather had been warm, exhibited a fleshy globule towards the middle of the trunk, very soft, and of a whitish ash colour, in which there was no organization either within or without. However, in eight or ten days more, a sensible change took place; the globule became much larger, the rudiments of the lips were evident, as also those of the small horns, the mouth, the tongue, and a membranaceous substance fixed in the upper jaw, which proved to be the new tooth of the snail. These parts develop further, and grow more con-

spicuous ; they successively occupy greater space in the trunk ; and, in two or three months at most, the injury is repaired in such a manner, that, unless from the lighter colour, the new head is not to be distinguished from the old one.

This remarkable property in the snail has since been confirmed by other persons, who have repeated the Professor's experiments. Among the number that communicated their success to Spallanzani, was Sig. Gerardi, an Italian anatomist, in whose letter we find the following passage :

" Whenever the head is finished, the snail uses the renovated parts to repair the long abstinence it has been forced to undergo. During the beginning of October last year, I profited by a gentle shower to examine all the animals that issued from the shell. One of those people was with me who are naturally incredulous, and never less disposed to believe any thing than what borders on the marvellous. Not only was he obliged to acknowledge that the head was really reproduced, but he observed one endeavouring, with its prominent teeth, to gnaw a particle of bran, partly adhering to the shell, and in an inconvenient place. It was entertaining to see, in the snail's exertions, the repeated action and re-action of the open mouth, the soft lips, tongue, and teeth, turning the particle a thousand ways, until it effected separation, and made itself a savoury mouthful."

Several years ago an attempt was made in this country to introduce the *Helix pomatia,* a species of

snail well known, and much esteemed among the Romans, who kept them in *cochlearia*, or places appropriated to the purpose, where they were fattened with bran and wine lees. Mr. Pennant says, Sir Kenelm Digby first imported them from Italy, but whether for medical purposes, or as an article of food, is uncertain. However this may be, the species is still confined to certain counties, and, though common enough in Surry, is by no means plentiful elsewhere.

On some parts of the Continent these slimy animals are still admired, and Dr. Townson was shown at Erlaw a complete snailery, constructed, as the proprietor informed him, on an improved plan. This was merely a hole dug in the ground to the depth of two or three feet, and covered with a sort of wooden house.

This species is much larger than the garden snail, and is of a brownish yellow colour, marked with three faint bands. It provides against the inclemency of winter, by retiring to a warm hole, and closing the mouth of the shell with a thick cover or operculum. In this state it remains till the spring be sufficiently advanced to entice it from its hiding-place, when it creeps forth, and presently recruits the loss of flesh which it sustained during its retirement.

SHIP-WORM.

GENERIC CHARACTER.

Shell a small taper tube, open at each end.

SPECIFIC CHARACTER.

TEREDO NAVALIS.	T. testa tenuissima cylindrica lævi. *Linn. Syst. Nat. Gmel.* 1. p. 3747.
	Shell very thin, smooth and cylindrical.
	Serpula testa cylindracea flexuosa, lignum perforans. *Anon. Conch.* pl. 10. f. 1 and 4.
SHIP-WORM.	*Phil. Trans.* 1741. no. 455. pl. 2. *Baster. Penn. Brit. Zool.* 4. no. 160. *Da Cost. Brit. Conch.* p. 21. *Montague Test. Brit.* p. 527.

THE animal which inhabits this tubular shell has been long known, and always dreaded, on account of the mischief it does to our timber, and particularly to the bottoms of our vessels. The hardest oak is no defence against its persevering industry, but in time becomes perforated in every part, and doomed to decay. As the teredo, though very insignificant in itself, has become of consequence on account of its destructive power, we shall

be rather more particular in our description of the shell, and its inhabitant, than we have hitherto been with the testaceous animals.

Mr. Montague, to whose account we are chiefly indebted for what follows, describes the shell as thin, brittle, and flexuous. It is of a whitish colour, and becomes thick and strong towards the smaller end. The aperture is round, and the head of the animal is covered by two testaceous hemispherical valves, partly projecting in a sharp angle, and striated in a longitudinal direction with great regularity. The inside of each valve is furnished with a long, flat, and curved tooth. Near the extremity of the tail of the animal are fixed two lanceolate plates, or valves, one on each side; the office of which is to close the extremity of the tube at the thickened part. "These," says Mr. Montague, "seem to be properly the shells of the animal, being attached to it. The tubular testaceous case, or sheath, which lines the hole made by this animal in wood, though necessary to its existence, appears only to be formed as an apartment in which it may move with ease and security; for it is observable that no two tubes ever touch each other, although the lamina of wood between them is frequently not thicker than paper. The tube is seldom so long as the animal, as the anterior part of the perforation is usually not lined with it for two inches or more; the smaller end is always even with the surface of the timber perforated, but so small as not easily to

be discovered; but sufficient to admit the surrounding element, and which the animal can regulate by the posterior valves."

The animal, in its operations, instinctively follows the grain of the wood, and never bores across it if the difficulty can possibly be avoided; for, after having penetrated a little way, it turns and continues nearly in a parallel direction till it is obstructed either by a knot in the wood or another workman of its own species: its course then depends entirely on the nature of the obstacle; and, if the resistance is not to be overcome, it will make a short turn in the form of a syphon, rather than bore any distance across the grain.

Mr. Montague examined a great number of these shells in the dock-yard of Plymouth, where every means have been tried to prevent their destructive operations. The piles, he examined, had been recently taken up to be replaced with new; these, he was informed, had not been under water above four or five years, and were in that time greatly perforated, though made of sound and solid oak. This rapid destruction in the timbers has suggested the propriety of the method now adopted in the dock-yards to secure them. All that part which is continually under water, is covered with short broad-headed nails, which the sea salt soon converts into a strong coating of rust, impenetrable to these animals, and even said to be superior to a sheathing of copper.

The shell is rarely above three quarters of an inch in diameter at the larger end, and a foot in length, in our seas; but exceeds these dimensions in the warmer climates; from whence it was originally brought into our harbours, and is now unfortunately become too common.

ZOOPHYTES.

UNDER the title of the Zoophytes, Linnæus has arranged all the Corallines, to which he has added the genus Hydra, consisting of animals deservedly admired for their wonderful reproductive power. The various productions which come under the denomination of corallines, were formerly supposed to be of vegetable origin, and, like other plants, to be produced from their own proper seed. The little creatures issuing from the cells in their sides, and expanding their tender transparent arms in search of food, were supposed to be flowers in the act of blowing, and from their receding, when disturbed, they might be said to partake of the nature of sensitive plants, which contract their leaves whenever they are touched. The idea of their vegetable nature, however, though once strongly supported, and by most persons firmly believed, was at length shaken by some enlightened naturalists, and finally refuted by the ingenious Mr. Ellis. This gentleman, with a strong inclination for the study of natural history, and a persevering industry in the pursuit of knowledge, proved beyond a doubt that the different species of corallines are the work of an infinite number

of minute polypes, which form their habitations as bees do their honey-comb; with this difference, that the honey-comb always assumes one shape, whereas corallines are of various figures.

As it is always pleasing to observe the progress of knowledge, and to trace the origin of any discovery that may tend to rectify our errors, we shall here notice the circumstances that induced Mr. Ellis to pay particular attention to these marine productions. In the autumn of the year 1751, he received a curious collection of sea plants and corallines from the island of Anglesea in North Wales; and, in order to preserve some of the most beautiful kinds, he expanded them on paper in fresh water, and took some pains to lay them out with exactness. After they were completely dried, he disposed them so as to form a kind of landscape of different colours, and contrived to represent a variety of hills, dales, and rocks, that added greatly to the beauty of his design. While he was thus amusing himself, the celebrated Dr. Hales paid him a visit, and was so much pleased with these natural landscapes, that he desired Mr. Ellis to make some of the same kind for her Royal Highness the Princess Dowager of Wales, that the young princesses might learn to dispose the plants in the same picturesque manner. For this purpose he was further requested to collect all the varieties of our coasts, in which employ he was much assisted by his friend Mr. George Shelvocke. It is necessary to mention these particulars, as they led immediately to his future discoveries; for it is more

than probable, that unless he had been stimulated by the consideration of the high personage to whom all his labours were directed, he would never have made this part of natural history his particular study. From the observations which Mr. Ellis made while constructing his marine pictures, he was convinced that several of the subjects, which had hitherto been considered by naturalists as vegetables, were in reality of animal production. This opinion was so strongly seconded by many of his friends, that he resolved to determine how far his suspicions were just, by examining the substances in their recent state. For this purpose, in August 1752, he went to the Island of Sheppey, and took with him a celebrated artist, that the subjects which he thought worthy of preservation might be faithfully represented. There he had an opportunity of seeing those disputed beings, called branched corallines, alive in sea-water; and, by the help of a microscope, was fully convinced that these apparent plants were ramified animals in their proper skins; not locomotive, but fixed to the shells of oysters, muscles, &c. While residing in this place, he had an opportunity of observing the animal inhabitant of the Great Tooth Coralline; and his success in this first essay induced him to pursue the inquiry with attention.

During his stay at Brighthelmstone, in the summer of 1754, in company with that excellent artist Mr. Ehret, he observed a great variety of corallines, which were faithfully committed to paper by his

friend; and the drawings, together with an account of this excursion, were presented to the Royal Society. On several parts of the corallines he noticed little bodies, which, through the microscope, appeared to be so many vesicles or bladders. " To the use of these," says Mr. Ellis, " I was altogether a stranger till this journey: but now I discovered that they were *matrices*, or habitations of young polypes, which are produced here and there on the sides of the parent, as in the fresh-water polype; only in the marine ones they are protected with this vesicular covering. These vesicles appearing at a certain season of the year, according to the different species of corallines, and then falling off, like the blossoms or seeds of plants, have made some curious persons, who have not had an opportunity of seeing the animals alive in the vesicles, conclude them to be the seed-vessels of plants; and into this mistake I was led myself, in the account laid before the Royal Society in 1752. In which account I had taken some pains to point out the great similitude between the vesicles, and denticulated appearance of some of these corallines; and the tooth-shaped leaves and seed-vessels of some species of land-mosses, particularly of the hypnum and bryum."

In this manner did the indefatigable Mr. Ellis clearly prove the nature of these marine substances, and open the way for those who were yet doubtful, to satisfy themselves of the truth of what he advanced.

CORALLINES.

The corallines of our coasts are chiefly of a horny consistence, and in their appearance very much resemble plants. They grow, as we have already remarked, in different forms, and from thence have been distinguished by different specific names. The *Sertularia abietina*, or sea-fir coralline, is one of the most common, and will serve to illustrate what has been advanced respecting their animal nature in a very satisfactory manner. It is found attached to various shells, and grows to the height of three or four inches. It may be readily distinguished by its fir-like appearance and alternate branches, which are set with little denticles, somewhat of a conical shape. If a small portion of this coralline, soon after it has been dredged from the sea, be put on the stage of a single microscope (in a drop of sea-water), the polypes will presently be seen stretching out their arms in search of food. This is a very pleasing object, and highly calculated to excite the astonishment of those who are unaccustomed to examine Nature on so small a scale. Many who spend a certain portion of every year on the different coasts of this kingdom, will find themselves amply repaid for the trouble of searching out these things, by the amusement they will afford them: for their information we shall subjoin the methods which Mr. Ellis recommends, for preserving the polypes in an expanded state, so that they may be sent to

any distance, and exhibited to those who have no opportunity to examine them alive.

" The greatest variety of corallines," says this gentleman, " are to be found on what are generally called rock oysters, or upon those beds of oysters that have been for some time disused or neglected. Upon such I have seen them grow as it were in little groves. As soon as the fishermen take these oysters out of the sea, let them immediately put them into buckets of sea-water; for the animals are of so tender a nature that the air soon shrivels them up. As soon as they can conveniently, let them be brought on shore, and stripped of the shells with a pair of pincers, taking hold of them near where they adhere to the shells; then put them gently into white earthen plates full of clear sea-water; and in about an hour, or perhaps less, they will begin to recover from this rough treatment; and many of the animals will begin to extend themselves; this you may observe by a magnifying glass of about two inches' focus. Those that you perceive extended and alive, may be suddenly taken out with the pincers, and instantly immersed in any kind of spirits, which you may have by you in an open vessel for that purpose. This will fix the animals in such a manner, that when they are put into wide-mouthed, strong glass bottles full of the same spirits, and well corked, many varieties may be sent together to a great distance, without prejudice to the figure of the animals, as I have experienced.

"Or this method may be tried:—that is, to place the oysters with the corallines on them in broad earthen or wooden vessels, with as much sea-water over them as will barely cover them; let them rest an hour, and then pour boiling water gently by the side of the vessel, to about the same quantity that there was of cold water in the vessels. Immediately afterwards pluck the corallines off the shells, and put them in bottles of spirits as before. When they are received, in order to be examined, you must provide long narrow bottles of crystal glass to put the different sorts in; these must have wide mouths, and be filled with the clearest spirits, but not stronger than proof brandy; and of such a diameter as shall be agreeable to the focus of the glass you propose to examine them by. If these bottles are properly stopped to prevent the spirits evaporating, it will be the best method I know of keeping these extraordinary plant-like animals in a condition capable of convincing the most incredulous of their nature and origin."

But few of the corallines which are found in the warmer parts of the world, bear any resemblance, either in form or texture, to those which grow in our sea. They are for the most part of a testaceous nature, and effervesce strongly in acids. Large forests of these submarine productions are to be met with on the southern coasts of America, as well as in other parts of the world; and the different forms they assume, are seen to advantage in those seas, where the water is frequently clear

enough for a person to distinguish any substance at a considerable depth. These aquatic groves are composed of a great variety of species, which, astonishing as it may appear, are all constructed by the tender little creatures that inhabit them. If we give ourselves time to consider the many wonderful processes in nature which are daily performed before our eyes, but which, from their frequency, are wholly disregarded, we shall be the less surprised to find these minute and glutinous animals constructing their habitations of materials almost as hard as marble. It is not merely the immense labour of these little polypes that we have to admire; for they possess the art of giving a very beautiful finish to their calcareous structures, and proceed with a regularity in their operations that it will be difficult for us to conceive. Some exactly resemble large mushrooms with their gills upwards; others take the form of different trees, and some again have a surface like the finest lace. Among them the *Tubipora musica*, or red pipe coralline, is one of the most common, and is found in great abundance in several parts of the world. We suspect this to be the principal species which forms the group of the thousand islands in the Strait of Sunda, which are mentioned by Mr. Barrow as being wholly formed of coralline. This gentleman observes, that from the soft and leather-like consistence of the tubulated surfaces of the coral fabrics, it would appear that as the old animals die, and their calcareous cells become rigid, succeeding

generations continue their operations on the upper and lateral surfaces, each according to the particular form which Nature has prescribed. The great masses of coral rock, according to Mr. Barrow, appear to be composed chiefly of *madrepores*, *cellipores*, and *tubipores*. In order to determine whether the central parts of a coral island were composed of the same materials as the shore, he removed the soil to the depth of about three feet, and found large blocks of madrepores, with various cellular masses of calcareous formation.

Thus by imperceptible gradations, and in an almost inconceivable manner, do these apparently insignificant beings raise huge masses of durable rock, which at length appear above the surface of the sea, and soon become covered with vegetables.

The stony habitations of these little creatures, in which they can conceal themselves at pleasure, are highly necessary for their preservation, and defend them from the rude attacks of a boisterous element, as well as from the many enemies which constantly surround them. The fresh-water polype, on the contrary, which we are now about to describe, being confined to the calm and sheltered situation of ponds and ditches, does not stand in need of so necessary a provision for its defence, and is therefore denied the power of forming any covering.

FRESH-WATER POLYPE.

GENERIC CHARACTER.

A contractile animal affixed to some substance by its base, and provided with a number of tentacula surrounding its mouth.

SPECIFIC CHARACTER.

HYDRA FUSCA. . . . H. tentaculis suboctonis longissimis. *Linn. Syst. Nat. Gmel.* 1. p. 3870.
Polype with eight long arms.
Hydra corpore cordato griseo, cirrhis multoties longioribus. *Pallas El. Zooph.* p. 29. no. 1.

FRESH-WATER POLYPE. *Ellis Corall.* pl. 28. f. C. *Tremb. Polyp.* 1. p. 22. pl. 1. f. 3, 4. *Schæff. Polyp.* 1754. pl. 3. f. 1.

WE are indebted to the indefatigable researches of M. Trembley for the natural history of this little animal, which makes so insignificant a figure in the wide field of nature, that till his time we had no regular account of its wonderful properties. It was a doubt, when first discovered, whether the polype was a vegetable or an animal substance; and so nearly is it allied in appearance to a plant, that it

was some time before M. Trembley could satisfy himself of its real nature.

In the description of this species may be included two others, the *green* and the *gray* polype; both of which, like the brown, are common either in ditches, ponds, or slow-running streams. These diminutive objects may be found, in the spring, adhering to all sorts of aquatic plants, and to any loose substance that may be lying in the water. When first taken up they appear like a small dot of transparent jelly, and would be rejected, by those not aware of their curious conformation, as the exuviæ of some fresh-water insect. One of their most common haunts is under the leaves of duck-weed, which can hardly be taken up in any quantity, in the spring of the year, without some of these animals adhering to it. After the water which contains them has been at rest for a short time, these little lumps of jelly will be seen gradually to expand, and take the form of a stalk, from the top of which eight slender filaments (if this species is examined) will make their appearance and arrange themselves round the centre, where the mouth is situated. In this form it looks so like a vegetable, that Trembley, in a letter written to M. Bonnet in January 1741, says, " I have studied it ever since June last, and have found in it striking characteristics of both plant and animal. It is a little aquatic being. At first sight every one imagines it to be a plant; but if it be a plant, it is sensitive and am-

bulant; if it be an animal, it may be propagated by slips and cuttings, like many plants."

Some of these animals are capable of extending their tentacula, or arms, to a considerable length; we have seen them full six inches long, and so slender that their extremities could hardly be observed. With these arms they secure their prey, and no insect less than themselves can escape them. If a small worm happens to come in contact with one of the arms, it is immediately seized without a possibility of retreating. The little creature endeavours in vain to disengage itself, often swimming and dragging the arm from one side of the glass to the other. The polype, in order to counteract these exertions, contracts itself as much as possible, and thus brings the worm within the reach of its other arms; when it is presently conveyed to the mouth, and gradually swallowed. After the worm is completely ingorged, it may be distinctly seen through the transparent sides of the polype; and if the animal be conveyed under a microscope, the process of digestion will become visible. This is effected by the motion of the stomach, which continually pushes the aliment backwards and forwards till it is sufficiently softened and has lost all traces of its original form.

Sometimes several polypes will seize on a small worm, and each dispute the prize. When two of them happen to contend for the same object, they drag it with great force in opposite directions. It often happens that while one is swallowing its

respective end, the other is employed in the same manner, and thus they continue to swallow, each his part, till their two mouths meet together. They then rest for some time in this situation, till the worm breaks between them, and each goes off with his share. It is not worms alone which afford nourishment to these aquatic curiosities, but all the animalculæ that are manageable are devoured when they come within their grasp.

These animals are propagated in a very singular manner. If one of them be carefully examined in the summer, when in full vigour, a number of small tubercles will, after some time, be perceived on the sides, which become larger and larger every day, till at length what appeared to be at first a small excrescence becomes a complete animal, resembling in every respect the parent, from whose sides it was produced. Thus the original polype, from a simple stalk, is changed into a many-headed hydra, resembling a tree in miniature with all its flourishing branches. But this singular property does not cease here; for the young themselves, after a while, produce a new series from their sides; bud like the parent, and little ones proceed from them in the same manner as *they* formerly were brought forth. Several generations are often thus attached to one another, and form a kind of animal society, in which all participate in the same life and the same wants. In this manner is a surprising chain of existence continued, and numbers of animals naturally produced, till this hydra is decomposed, to

give birth to new generations, or fresh genealogical trees.

The polype possesses a most remarkable reproductive power, and seems to bid defiance to the knife; which only separates its limbs to make them rise again with redoubled vigour. Other animals are capable of renewing certain parts, and snails will even reproduce a head; but these phænomena are not to be compared with what the polype can execute. This animal exceeds the fabulous relation of the Lernean hydra; for, when divided in every direction, it will not only exist, but produce a perfect animal from every mutilated part. This species of fecundity is so great in these animals, that even a small piece of their skin will become a little polype, a new animal rising as it were from the reins of the old. If the young ones which grow from the sides of the parent are deprived of any part of their bodies, the injury will be soon repaired, and the creatures become as perfect as ever. The same thing takes place with the parent, which will even put forth young before its mutilated parts are reproduced.

Astonishing as this may appear, to those persons who have been unaccustomed to consider the subject, it is strictly true: the facts do not rest merely on the authority of Trembley; they have been proved by others, who have repeated his experiments; we shall therefore proceed without hesitation to relate some of the most striking instances of the reproductive power of this little animal.

When a polype is slit down to the middle of its body, two heads will be formed, and the animal will feed at the same time with both. If it is slit into six or seven parts, each part produces a new head, and the animal becomes a hydra. To whatever lengths this division is carried, it signifies nothing; the creature is not by this means to be destroyed; but, on the contrary, produces a perfect being from every fragment. This is not all; for they may be as it were grafted together. If the truncated pieces of a polype be placed end to end, and then pushed together with a gentle force, they will unite and form a single one. In the same manner pieces of different polypes may be united; the head of one may be fixed on the trunk of another, and the consequence will be a perfect animal, which will grow, eat, and perform all the functions of its humble station, as well as any of the rest.

Another mode of uniting these creatures has been effected, and is still more extraordinary. One polype has been introduced into the body of another, by pushing it through the mouth, till the two heads are brought together. If confined in this manner for some time, the two animals will be as it were formed into one, having double the number of arms, but not differing in any other respect from the single polype.

It must be confessed that what we have already related respecting these animals is very extraordinary; and yet what we are now going to say is still more so, since there is nothing at all analogous

to it in the whole range of animated nature. If a polype be turned inside out like a glove, it will live and act as before. The lining or coating of the stomach now forms the skin, and the former skin now constitutes the coating of the stomach. A polype thus turned may often have young ones attached to its side. When this happens they must of course be inclosed in the stomach, and as they increase in size, they stretch towards the mouth of the parent, that they may escape when separated from the body. Sometimes, while very small, they turn themselves inside out, and thus avoid the necessity of creeping through the mouth.

Thus we have noticed the most striking particulars in the natural history of this singular creature; and when we consider the various properties this little animated lump of jelly is capable of exerting, we are lost in astonishment. In this particular instance, man may be said to exercise at pleasure a kind of creative power. He can out of one life make two, each completely formed with all its apparatus and functions, each with its perceptions and powers of motion and self-preservation, each as complete in all respects as that from which it derived its existence, and equally enjoying the humble gratifications of its nature. We are aware that many who read the account of these very singular animals, without having had an opportunity of ascertaining the truth of our relation, will be inclined to doubt the whole: but let it be remembered, that the most

common operations, both of the animal and vegetable world, are all in themselves astonishing; and nothing but daily experience, and constant observation, can make us see, without amazement, an animal bring forth another of the same kind, or a tree blossom and bear leaves and fruit.

END OF THE SECOND VOLUME.

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